SCIENTIFIC AMERICAN

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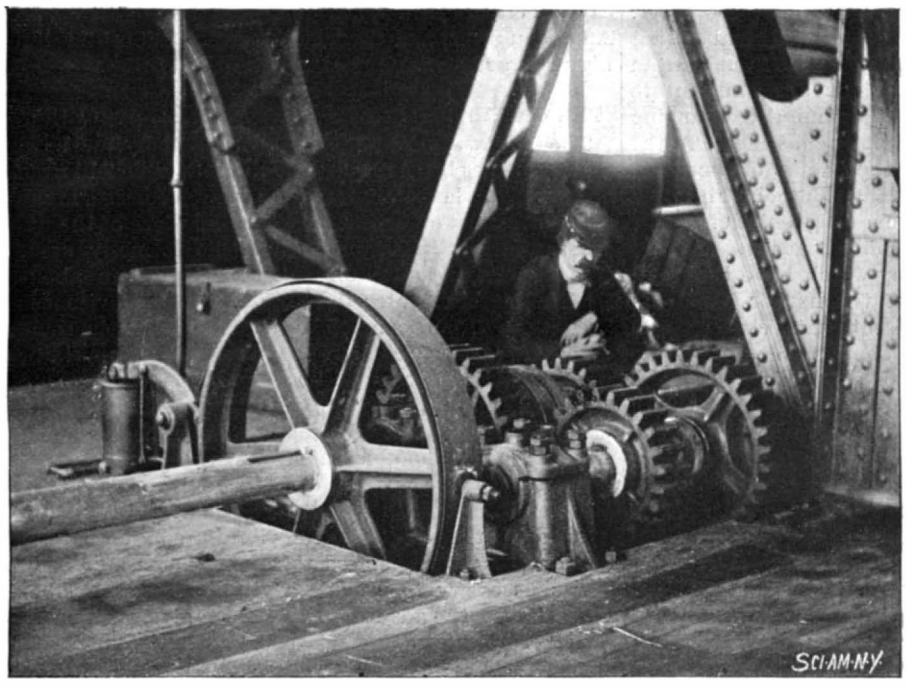
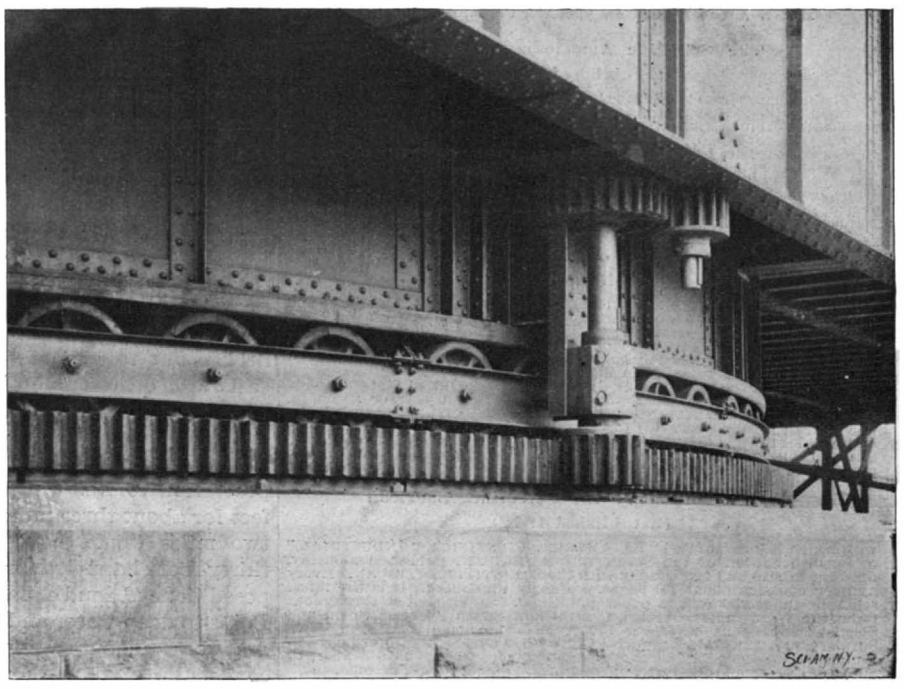
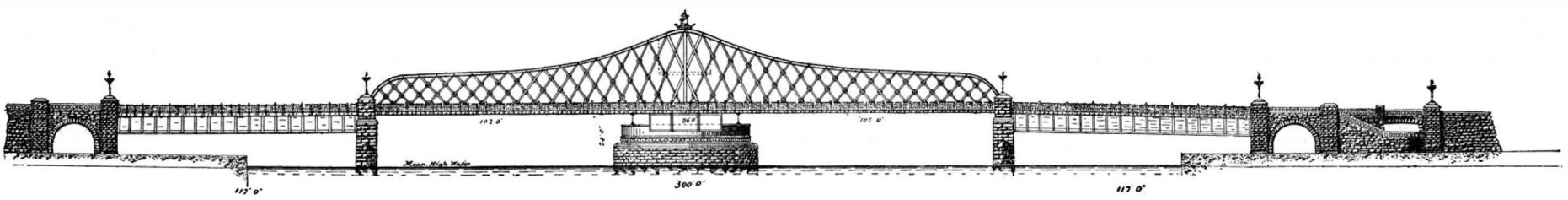


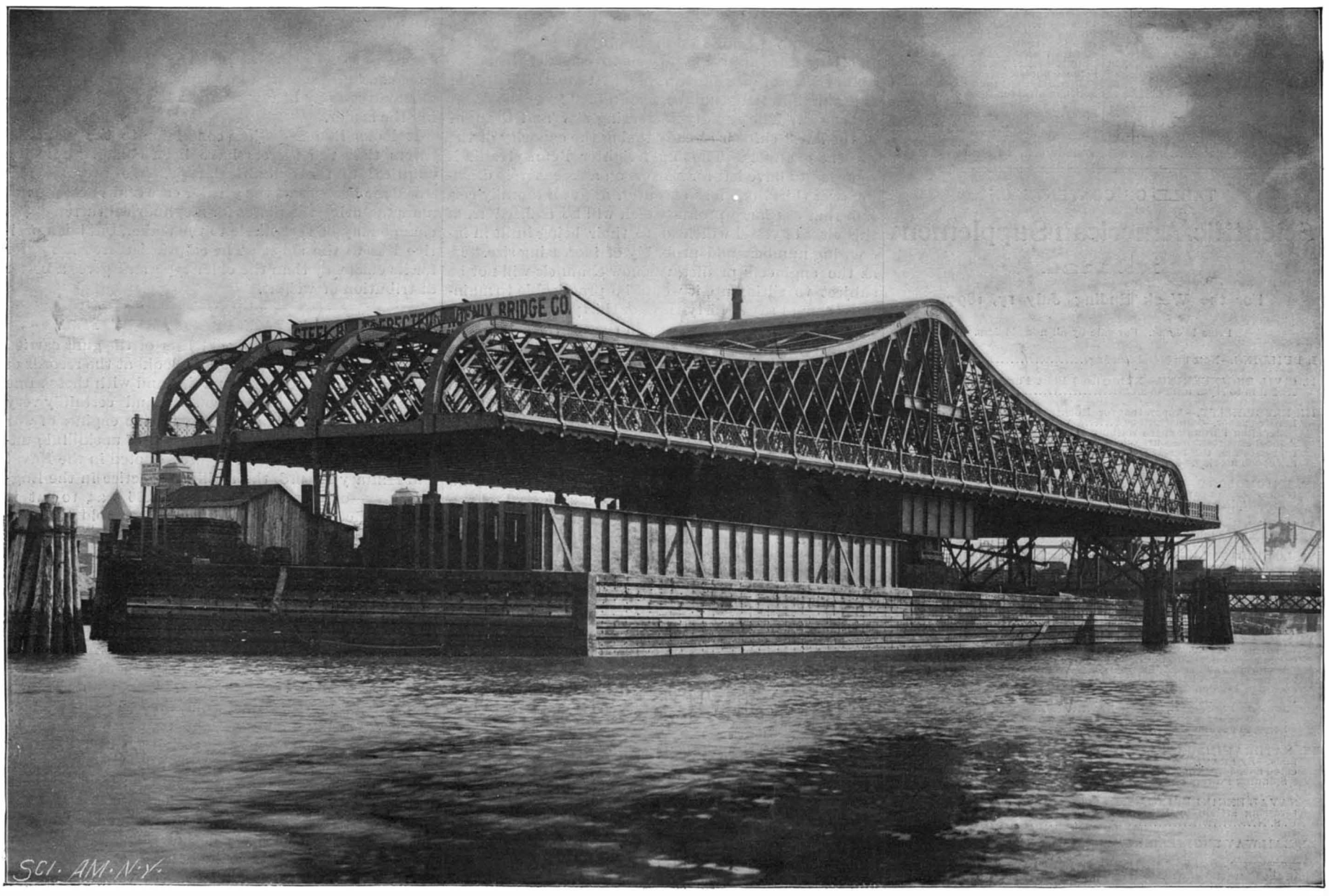
HYDRAULIC BRAKE FOR CHECKING DRAWSPAN.



DRUM AND TURNING GEAR OF DRAWSPAN.



HARLEM RIVER DRAWBRIDGE AT THIRD AVENUE.



THIRD AVENUE DRAWSPAN ACROSS THE HARLEM RIVER, NEW YORK.

Length, 300 feet; breadth, 86 feet; weight, 2,500 tons.—[See page 41.]

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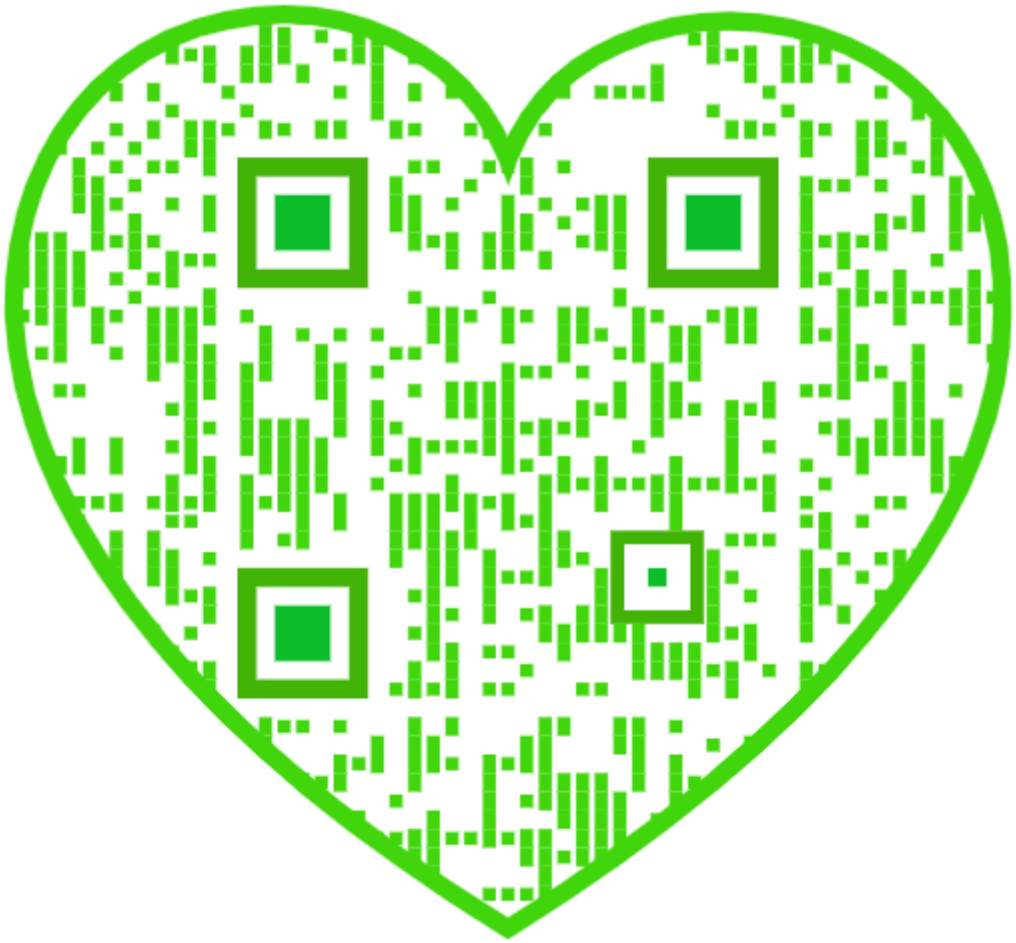

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IMPROVEMENT OF THE ENTRANCE TO NEW YORK HARBOR.

There is a growing conviction among those who are interested in the welfare of the Port of New York that it is imperative that something be done to improve the entrances to the harbor. At present, entrance is made through a thirty-foot channel which is partly natural and partly artificial. This is known as the main ship channel, and the minimum depth of thirty feet is only maintained at the cost of continuous and very expensive dredging. From the thirty-foot line outside Sandy Hook it runs in a westerly direction for about six miles to a point about a mile and a half inside the Hook, where it turns abruptly to the north.

This sharp turn is a source of anxiety and danger to shipping, especially in foggy weather; moreover, the dredged channel is subject to continual silting up by the matter which is washed into it from Raritan Bay; and furthermore, its width is not sufficient to allow safe navigation when a large number of incoming and outgoing ships are meeting in the channel. To the east of the main channel are the Swash channel, the East channel and the Coney Island channel. These are considerably shallower and are used by ships of lighter draught than the large ocean-going boats.

The latest plan of the many which have been proposed for the improvement of the harbor entrances proposes to abandon the present main channel and dredge out two separate and shorter channels to the eastward, on the line of the present East and Coney Island channels. The East channel lies to the east of Romer Shoals, a permanent bank which intercepts the silt coming out of Raritan Bay, and affords a natural protection to this channel. It has a depth of thirty feet for about three miles of its length, and only about two miles would have to be dredged out to open a thirty-foot channel clear through to the sea. The proposed Coney Island channel would extend from Norton's Point to deep water and necessitate about four miles of dredging. The dredging in the new channels would be carried down to a depth of thirty feet, and as they would both be protected from silt by the Romer Shoals, it is reasonably supposed that there would be no difficulty in maintaining the required depth of water.

The advantages of having two separate channels for outgoing and incoming ships are many and obvious, and chief among them would be the lessened risk of collision. It has been pointed out that, if a modern liner, with her two hundred yards or more of length, were to be sunk across the present channel, the Port of New York would be practically shut up until she could be floated or the wreck removed. The possession of an alternative channel would remove this possibility, as, with proper care, the remaining channel—in case of such obstruction—could be used by both outward and inward bound ships.

Now that the question of improvement is being actively agitated, it would be well to consider the advisability of adopting a greater depth than thirty feet as the minimum that shall be maintained from the docks to the sea. The rapidly increasing size and draught of the latest ships is already taxing the capacity of the present channels. The big freighter Pennsylvania is reported to have left for Europe on a recent trip drawing over thirty-one feet of water, and it is morally certain that the large profits which will be realized from this class of vessel will lead to their being built in increasing numbers and probably of increasing size. If, as the engineers predict, the new channels will not be subject to silting up, it would be practicable to maintain them at say a thirty-three or thirty-four foot depth without any material increase in the cost.

THE THIRD RAIL SYSTEM IN ENGLAND.

The latest addition to the system of underground railways in London will probably rank as the most important of all these lines before it has been very long in operation. It will be known as the Central London Railway, and, starting from the busy Liverpool Street Station in the City, it will run by way of Holborn and Oxford Street, along the northern side of Hyde Park to Shepherd's Bush, a distance of six miles and a half through the busiest part of London. The road will be about sixty-five feet below street level, and will be carried in two separate and parallel tunnels—a similar plan to that adopted in the Southwark underground railway in the same city. Each station will be served by two elevators and two stairways.

The new undertaking will have especial interest for this country, from the fact that the electrical equipment of the road itself and of the extensive system of elevators by which it will be served will be furnished by American firms.

The third rail equipment will be put in by the representatives in England of the General Electric Company—the British Thomson-Houston Company. It will be similar in its general outlines to that which was employed by the General Electric Company on the New York, New Haven and Hartford Railway, and illustrated in the SCIENTIFIC AMERICAN for June 12 and 26.

The conductor will consist of an insulated third rail, placed on the ties between the main rails. The service will differ from that on the New Haven line, however, in that the trains will be hauled by separate electric locomotives, whose general appearance will conform to the well known heavy locomotives which are being used in the Belt line tunnel, at Baltimore. On the New Haven line, it will be remembered, the motor cars have full accommodations for passengers. The change is made to accommodate the reduced clearance of the tunnels. Equally interesting will be the extensive elevator equipment. There will be forty-nine in all, and they will be of the well known double drum Sprague type. Their capacity will be 100 passengers per trip, or a load of about 15,000 pounds.

It is very gratifying to note that the whole of the electrical equipment of such an important work in the capital city of the world has been secured by two American firms, and the fact is a direct tribute to the high character of electrical work in this country.

THE MOORE SYSTEM OF VACUUM TUBE LIGHTING.

The Moore system of electric lighting by means of vacuum tubes has received very material benefit from the inventor's latest improvement, which consists in the use of a rotary current interrupter in place of the vibrating current interrupter which he formerly used. With the latter it was only possible to obtain about 6,000 breaks a minute; but with the rotary device it is possible to obtain as many as 50,000 breaks in the same time. The rotator consists of a revolving commutator which carries a series of brushes. The segments are arranged on the periphery of a rotating cylinder which is inclosed in a vacuum tube together with the armature of the motor which drives the commutator cylinder. On the outside of the tube are placed the field magnets which influence the armature. The substitution of the rotator for the vibrator enables a number of tubes to be operated together, whereas formerly it was necessary to provide a vibrator for each tube. There is also the advantage that for a given volume of light the consumption of electrical energy is much less than it was with the vibrating device.

THE ARMOR PLATE COMPROMISE.

It must be confessed that the so-called armor plate compromise seems to give the manufacturers pretty much everything they have asked. At any rate, it has shown the absurdity of the attempt to limit the rate which should be paid for armor to "$300 per ton of 2,240 pounds." It will be remembered that this price was rejected by the Bethlehem and Carnegie Companies, and that the subsequent increase to $400 per ton failed to meet with favorable consideration. As a last move the Naval Committee has agreed to fix the price at $425 per ton, and a provision has been incorporated in the General Deficiency bill which will cover the necessary appropriation. Action of some kind had to be taken, for the three battleships for which the armor is to be provided had advanced to a stage of construction where the government ran a serious risk of having to pay heavy penalties for delay in furnishing the armor.

It looks like a distinct concession to the manufacturers that the turrets have been changed from the elliptical to the cylindrical type. We presume this was done because of the greater ease and cheapness of manufacturing the plates for a cylindrical turret. This change may be acceptable to the maker, but it is a positive loss to the ships. The elliptical turret is lighter for its efficiency than the older type and gives a better distribution of weight.

THE INACCURACY OF ARTILLERY FIRE.

If we turn from the official lists of the guns carried by the navies of the world and look at the records of gun practice in these very navies and with these same guns, the effect is almost comical and certainly very surprising—so greatly are these terrific engines of war robbed of their power by the hands of unskillful gunners. According to some figures quoted in the Naval and Military Record, the artillery practice in the English navy—or a part of it—during 1896 was, to put it mildly, shockingly bad. Thus we are told that the Sanspareil, a sister ship to the ill-fated Victoria, fired seven shots from her huge 110 ton guns, every one of which missed the target. Now this giant gun is credited with awful powers of destruction, and on the proving grounds a test shell did actually tear a hole big enough for a man to creep into through a target of steel, wood, and stone, 42 feet in thickness.

Of what value, however, are these monsters if they cannot be made to shoot straight? The Benbow, which also carries two of these guns, fired six shots, all of which missed the target. The next size of guns, 67 tons, made better practice, scoring six times out of thirty-one shots; though this, in all conscience, was a pitiful exhibition. When we come to the antiquated muzzle loaders it is not surprising to learn that twenty-four shots from the guns of the Inflexible and the Dreadnaught failed, every one of them, to reach the mark. One would have looked for better results, however, from the smaller calibered 10 inch guns of the Thunderer and Sanspareil; but out of thirty-three shots fired by these ships, only two reached the target.

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Even with the 4·7 inch quick firer the united efforts of two cruisers and three gunboats required the expenditure of 174 shots to score on the target nineteen times. Some of the ships, of course, made much better practice; the Imperieuse, for instance, scoring twenty-two hits in twenty-seven rounds.

Although these figures will come as a great surprise, they are in strict agreement with the experience of all modern sea fights. There was a great disparity between the number of hits and the number of rounds fired in the last naval battle of any note—the fight between the Japanese and Chinese fleets at the Yalu; and, indeed, the whole history of naval warfare goes to show that it would be wiser to arm a ship with a few guns well served than load her down with a massive armament which is liable to be worthless on account of the poor marksmanship of its gunners. The great success of our ships in single combat with the enemy in the war of 1812 was due to the superior marksmanship of their gunners. It is urged that practice with modern guns is very costly, the price of one shot from a 110 ton gun being set down at $70; but the obvious reply to this is that it would be good policy to put the value of one or more guns into powder and shell for practice, rather than render the whole battery useless for want of capable marksmen.

THE FUTURE OF THE MOTOR CAR.

It is quite possible to overrate the significance of the failure of the two recent motor car competitions in England—those of The Engineer and of the Motor Car Club. The fact that many of the motor car builders failed to enter these competitions does not warrant the conviction that they have failed to produce a more or less satisfactory machine. The most we can suppose is that these firms did not consider that at this stage of their work there was anything to be gained by entering a stringent public competition. Moreover, it must not be forgotten that in the case of The Engineer's competition a large number of competitors asked for an extension of time—a fact which gives reason to believe that the half dozen machines which did put in an appearance by no means represented the number of bona fide concerns or individuals who are at work on the problem.

It is quite possible that the wonderful rapidity with which, in these days, a useful invention is developed from a crude idea into a practical shape with a positive commercial value has made us a little too exacting. We are intolerant of delay, and when, as in this case, the problem is full of difficulties peculiar to itself, we are apt to condemn it as impracticable, because it is not perfected with the usual rapidity. A correspondent writing to Industries and Iron regarding the recent competitions draws a very pertinent comparison between them and the celebrated Rainhill locomotive trials of seventy years ago. The comparison is well to the point, for the locomotive industry in 1829 was as much or more in its infancy than that of the motor car is to-day. It is pointed out in the first place that "had the establishment of the locomotive system depended on the leading engineers, it would have been swamped at the beginning." Again, it is noted that Stephenson was not afraid to enter for the competition, though two of the judges had formally reported against locomotives. The competition, moreover, was fully carried out, though only four engines entered and only one was capable of going through with the trials. Lastly, it does not appear that any engine was (or was likely to be) disqualified because, in the opinion of the judges, it was *à priori* unfit for its work, but only if it failed on actual trial to do the work required.

The above comparisons are well drawn, and in any future contest of the kind better results would undoubtedly be obtained by making the terms broad and simple. It is evident that in this matter we must learn to "walk before we can run," and the statement is true whether it be applied to the question of appearance, weight, size, noise, smell, speed, cost or any other of the qualities which go to make up a perfected motor car. The recent competitions have proved that the perfected car, considered as a commercial product and something more than a mere toy, has probably yet to be built—at least as far as Great Britain is concerned; but there is no cause to believe that satisfactory progress in the construction of such a car is not being made. There were about sixty-five years of interval between Stephenson's Rocket and the Queen Empress of the Scotch Express, or No. 999 of the Empire State Express, and we are still improving on the locomotive. With this comparison in mind, it is safe to say that among the certainties of the future are a motor car which shall be light, strong, swift, durable and cheap, which, as a means of banishing the noise and unsanitary filth of horse-propelled vehicles from our streets, and as a means of transportation for freight and passengers in country districts, will be as indispensable to the everyday life of the race as are the steam locomotive and the electric car of our day.

THE Paris Exhibition in 1900 will be the first in which all nations of the world, 54 in all, will be officially represented.—Uhland's Wochenschrift.

THE EVOLUTION OF MODERN SCIENTIFIC LABORATORIES.

Dr. William H. Welch, Professor of Pathology in the Johns Hopkins University, delivered an interesting address at the opening of the William Pepper Laboratory of Clinical Medicine at Philadelphia. The address was afterward published in the Johns Hopkins Hospital Bulletin. In brief he said that at the present day the systematic study and advancement of any physical or natural science, including the medical sciences, requires trained workers who can give their time to the work, suitably constructed workrooms, and equipment with all the instruments and appliances required for special work, a supply of the material to be studied and ready access to more important books and journals containing special literature of the sciences. All of these conditions are supplied by a well equipped and properly organized modern laboratory. Such laboratories are, with partial exception of the anatomical laboratory, entirely the creation of the present century and for the most part of the last fifty years. They have completely revolutionized during the past half century the material conditions under which scientific work was prosecuted. Dr. Welch then goes on to deplore the fact of the lack of monographic treatment of the general subject of the historical development of the scientific laboratory, He then refers to the state-supported institutions for study at Alexandria under the early Ptolemies and to the study of anatomy under the Hohenstaufen Frederick II. He then mentions the researches of Vesalius and Amos Comenius.

Methodical experimentation in the sciences of nature was definitely established by Galileo and was zealously practiced by his contemporaries and successors in the seventeenth century and was greatly promoted by the foundation during this century of various societies, such as the Accademia dei Lincei and the Accademia del Cimento in Italy, the Collegium Curiosum in Germany, the Académie des Sciences, and the Royal Society in England. Much of the classical apparatus still employed in physical experiments was invented at this period.

There existed in the last century cabinets of physical apparatus to be used in demonstrative lectures, but they were very inadequate, and suitable rooms for experimental work scarcely existed. It was not until about the middle of the present century that we find the beginning of the modern physical laboratory. Lord Kelvin, then William Thomson, established a physical laboratory in the University of Glasgow about 1845, in an old wine cellar of a house. It was as late as 1863 that Magnus opened in Berlin his laboratory for experimental physical research. Since 1870 there has been a rapid development in the splendid physical institutes which are the pride of German universities.

Humbler and more picturesque was the origin of the chemical laboratory. This was the laboratory of the alchemist seeking the philosopher's stone. One cannot read without combined feelings of wonder and pity of the incommodious, forlorn and cramped rooms in which such men as Scheele and Berzelius and Gay-Lussac worked out their memorable discoveries. It was the memory of his own experience which led Liebig, immediately after he was appointed professor of chemistry in Giessen, in 1824, to set about the establishment of a chemical laboratory. Liebig's laboratory, opened for students and investigators in 1825, is generally stated to be the first public scientific laboratory, although this is not quite correct. It is certain that Liebig's laboratory is the one that had the greatest influence on the subsequent establishment and organization of not only chemical laboratories, but public scientific laboratories in general. Its foundation marks an epoch in the history of science and scientific education. This laboratory proved to be of great import to medical science, for it is here, and by Liebig, that the foundations of modern physiological chemistry were laid.

In 1824 Purkinje succeeded in establishing a physiological laboratory, which, therefore, antedates by one year Liebig's chemical laboratory in Giessen, although it cannot be said to have exercised so great an influence upon the organization of scientific laboratories in general as did the latter.

Of modern physiological laboratories, the one which has exerted the greatest and most fruitful influence is unquestionably that of the late Prof. Ludwig, in Leipzig. To-day every properly equipped medical school has its physiological laboratory. This department is likely to hold its place as the best representative of exact experimental work in any medical science.

The first pathological laboratory was established by Virchow, in Berlin, in 1856. Virchow's laboratory has been the model as regards general plan of organization for nearly all pathological laboratories subsequently constructed in Germany and in other countries.

The first to formulate distinctly the conception of pharmacology as an experimental science, distinct from therapeutics and closely allied by its methods of work and by many of the problems of physiology, was Rudolph Buchheim. This he did after going to Dorpat in 1846; for in 1849 he established a pharmacological laboratory in his own house and by his private means. Later this laboratory became a department of the university and developed most fruitful activity. Buchheim's laboratory was the first pharmacological laboratory in the present acceptation of this term.

The medical science which was the latest to find domicile in its own independent laboratory is hygiene. To Pettenkofer belongs the credit of first establishing such a laboratory. In 1872 he secured under the Bavarian government the concession for a hygienic institute. This admirably equipped laboratory was open for students and investigators in 1878. By this time Koch had begun those epochal researches which added to the discoveries of Pasteur and introduced a new era in medicine.

It is apparent, from the brief outline which has been presented, that the birthplace of these laboratories, regarded as places freely opened for instruction and research in the natural sciences, was Germany. Such laboratories are the joy of German universities. By their aid Germany has secured since the middle of this century the palm for scientific education and discovery.

To the small number of existing well equipped chemical laboratories, the William Pepper Laboratory of Clinical Medicine is a most notable addition. It is the first laboratory of the kind provided with its own building and amply equipped for research in this country, and it is not surpassed in these respects by any in foreign countries. It is intended especially for investigation in the training of advanced students. It is a most worthy memorial of the father of its founder.

TEST OF THE BUFFINGTON-CROZIER DISAPPEARING GUN CARRIAGE.

The Buffington-Crozier disappearing gun carriage was recently tested with satisfactory results in the presence of General Alger, Secretary of War; General Flagler, Chief of Ordnance; and General Ruggles, Adjutant-General of the Army. The test was made during a visit of inspection by the secretary which included the government reservation, the mortar battery, gun emplacements and the buildings under construction for the garrison of Fort Hancock.

An illustrated description of this form of gun carriage was given in the SCIENTIFIC AMERICAN of March 14, 1896, to which the reader is referred. The article referred to shows an 8 inch gun mounted on a Buffington-Crozier carriage at Fort Wadsworth. The carriage which was tested at Sandy Hook carries a 12 inch gun weighing 116,000 pounds, the carriage itself weighing 350,000 pounds. The charge of powder weighs 475 pounds and the projectile 1,000 pounds.

The carriage is of the front pintle form. The weight of the gun is carried upon one end of a pair of massive cast steel levers, which are pivoted at their center and carry at their lower end a huge compensating balance or counterweight, weighing 150,000 pounds. When the gun is loaded and sighted the unlocking of a latch releases the levers and the counterweight descends into the pit in the center of the gun foundation, and raises the gun above the parapet of the fortification. The carriage has a rise of nine feet, which brings the gun up over the parapet on a plane sloping down toward the inside of the fortification at an angle of 7 degrees. The gun was fired with this elevation and the projectile struck the water about six and a half miles out to sea. The recoil of the gun is about four feet, and as the momentum of the gun is equal to that of an express engine with a train of ten Pullman cars running at fifty miles an hour, it can be understood what has to be done to arrest all this in a space of four feet.

The momentum is absorbed by the effort of raising the 150,000 pound counterweight as the gun sinks back to the loading position and by the resistance of the recoil cylinders on either side of the gun carriage. These cylinders are filled with oil, and a pair of pistons are caused to travel through them as the gun recoils. The pistons are perforated with slots through which work stationary bars of variable cross section. The area of the passage between the bars and the slots is so graduated that the shock of discharge is distributed throughout the four feet of recoil, the gun being brought gradually to rest.

The 12 inch gun carriage that was tested at the proving grounds was only temporarily in position, and when it is erected in its proper emplacement it will be protected by a massive wall of concrete and earth or sand.

AS one of the results of Nansen's north pole expedition, we see a number of similar undertakings planned by several individuals. First, a Frenchman, the engineer Andree, expected to fill his balloon on the 20th of June, in Sweden. From Spitzbergen the two French aeronauts Godard and Surcouf expect to depart, also by balloon, for the north pole, in the summer of 1898. The same season also Nansen's ship, the Fram, is once more to set sail under Capt. Sverdrup, the same who so successfully took command of the vessel on the last occasion. Nansen himself will be engaged in the working out of the results of the scientific researches made on the last expedition, and so will not be able to join this. Finally, a journey toward the north pole from the northern part of Greenland is planned by Engineer Peary.—Monatschrift für Offentlichen Baudienst.

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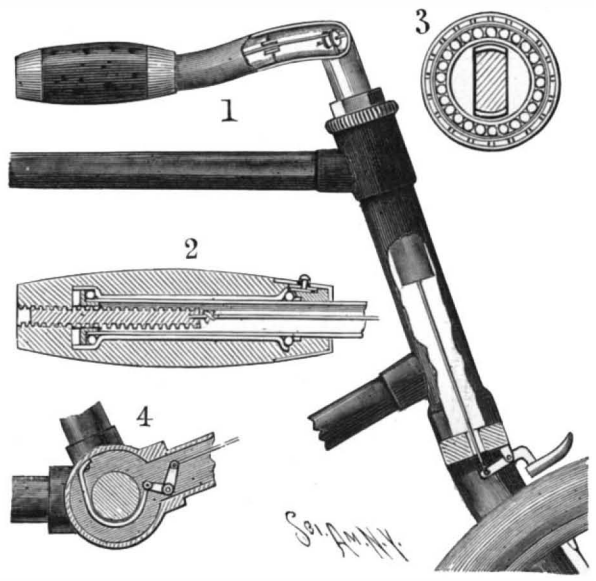
AN IMPROVED BICYCLE BRAKE.

A brake which is operated by merely turning the grip or handle, to force the brake shoe into engagement with the wheel tire, is represented in the accompanying illustration, and has been patented by W. H. Hart, Lieut. 7th Cavalry, U. S. A., Fort Grant, Arizona. Fig. 1 represents the application of the improvement on a bicycle, portions being broken out, and Figs. 2 and 3 show longitudinal and cross sections of the handle. The brake shoe is mounted on the outer end of a brake lever pivoted to a bearing extending across the crown of the forks, the other end of the lever being connected to a cord which extends up through the hollow steer-



HART'S BICYCLE BRAKE.

ing post and over rollers, through the hollow handle bar, its extremity being attached to a screw which has longitudinal movement in the handle. The screw is engaged by a nut which screws on the shouldered end portion of a sleeve in the hollow of the grip, such shouldered portion also forming a cone to receive a series of balls, there being a similar shoulder and series of balls at the opposite end of the sleeve. The nut forms a finish for the extremity of the grip, and the brake is applied by simply turning the grip, whereby endwise movement of the screw is effected and the cord is drawn upon to force the brake sleeve into engagement with the tire. In the inner end of the grip are annular teeth adapted to be engaged by a dog having a projecting operating stem by which the dog may be moved to engage the teeth and hold the grip against rotation on the arm of the handle bar. In Fig. 4 is shown a modified form of this improvement, according to which the brake sleeve is dispensed with, and the brake cord is extended through the lower brace bar to one arm of an elbow lever pivoted adjacent to the crank box, the opposite arm of the lever being connected with a spring brake band adapted to engage the crank shaft.

Photographs Upon Leather.

The leather is prepared by the usual process, and the work finished with pumice stone as though it was intended for varnished leather, then giving it a dressing of linseed oil boiled with litharge, and after drying it is necessary to give it a second rubbing. On this leather is spread a solution of gelatine with an addition of bichromate of ammonia, after which it is allowed to dry in the dark. When thoroughly dry exposure is made as for carbon paper. After this the leather is washed in lukewarm water with a sponge in order to remove the coating not affected by the light. By mixing some colored powders in the gelatinous solution, photographs are obtained of such a character as may be desired. It is also possible to work by transfer —indeed, this is even preferable.

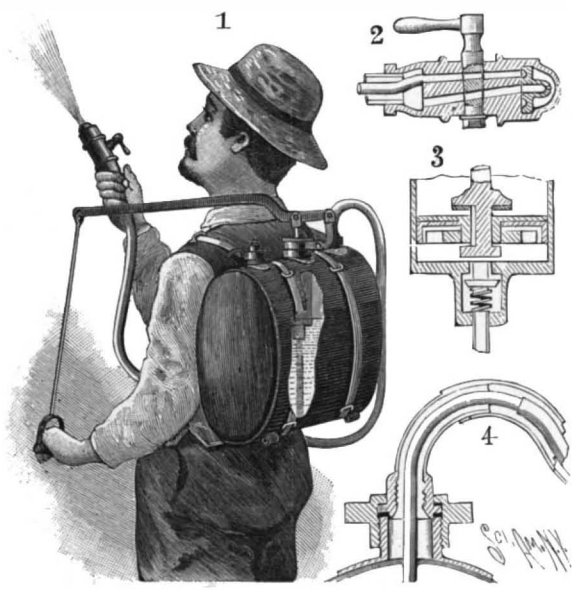
We place upon the leather photo process prints done with a special ink. This ink is composed of a solution of acetate of iron in glycerine mixed with fatty matter. The tannin of the leather coming in contact with the salt of iron gives an indelible black, forming the great feature of the photograph, and with a little skill the production of charming results is possible. Another excellent application of the photographic art, says Helios, is that of imitating fur. Even with a white skin for the purpose of producing designs and markings such as are common upon the skins of tigers, panthers, leopards, etc. Hitherto no absolute method has been used for this purpose.

The professional dyer works a good deal by chance and takes "pot luck" (using a popular expression). But photography comes to his assistance in working imitations, and serves to help in reproducing such designs that up to the present Dame Nature alone has held the monopoly. In order to imitate a tiger's skin, for example, it is necessary to possess a model, viz., an original skin. This is moistened with a paste of linseed (seeds of linseed boiled in twenty times their weight of water) on the hairy side of the skin. This is done by means of a brush, afterward with a sponge. A photograph of the skin is taken and transformed into a lithograph upon zinc about the size of the skin desired to be dyed, and transfer prints placed on it. The tiger's skin is then done over on the hair side with the linseed paste mentioned above, and the hairs are laid smooth in one direction. Then is applied the transfer printed on linen paper with an ink having as its base glycerine and artificial colors. This is allowed to remain in contact for some time in order to permit the hair to imbibe the coloring matter that is wished to be fixed; afterward, the linen paper can be removed by moistening the back.

By using an ink composed of glycerine containing a solution of paraphenylene-diamine, fat, and soap, it only remains (after having detached the paper) to pass oxygen water over the surface of the skin. A simple washing takes away the paste from the hair. The skin is then dressed by the usual methods. If the skin be of a reddish color, it is dyed before stripping it, preserving some portions white, so as to obtain a perfect imitation, copying nature as far as practicable in every detail.—Photography.

A PNEUMATIC SPRAYING APPARATUS.

With the portable apparatus shown herewith for spraying fruit trees, plants, etc., the size of the spray may be regulated or a stream may be ejected instead of a spray, it being also practicable to construct a similar apparatus of larger proportions, adapted to be supported upon wheels and thus drawn over the ground. The improvement has been patented by John Black, of Trafalgar Street, Nelson, New Zealand, and the inventor is represented in this country by Henry W. Peabody & Company, of Boston and New York. Fig. 1 represents the apparatus supported as a knapsack on the back of a person in position for use, Fig. 2 showing the nozzle, Fig. 3 a section of the pump employed, and Fig. 4 a section of the tubing and its connection with the tank. Extended downward in the latter, as shown in the broken away portion (Fig. 1), is the pump cylinder, the screw cap on whose outer end has perforations for the admission of air, while passing through and having a slight longitudinal movement in the piston is a piston rod in which is a port admitting air to the under side of the piston during its upward movement, as may be seen in Fig. 3. In the lower end of the pump cylinder is a spring-pressed valve, and communicating with the interior of the valve casing is a tube extending nearly to the bottom of the tank. Pivoted in lugs on a ring which turns on the upper end of the cylinder is an arm to which is pivoted the pump actuating lever, whose free end, from which depends a handle, may be swung in any direction most convenient to operate. At the top of the tank, on each side of the pump cylinder, is a hollow nipple, with either one of which the air and liquid tubes of the spraying hose may be connected. The exterior air tube has an annular rim designed to be pressed down upon a packing and the inner liquid tube extends down to the bottom of the tank, while an inner and

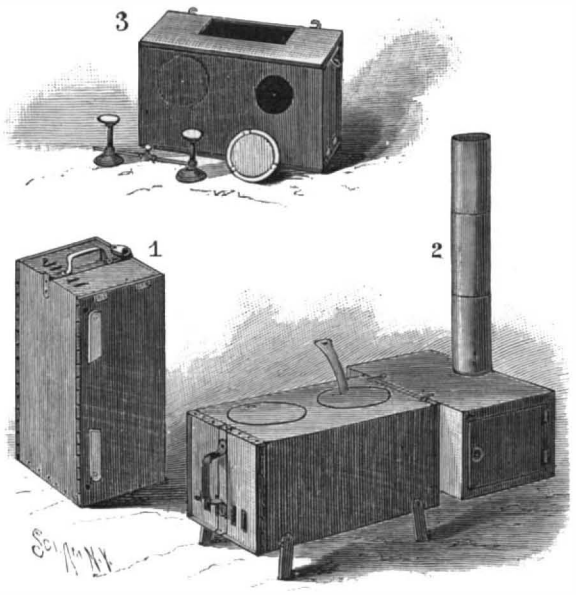


BLACK'S PNEUMATIC SPRAYING APPARATUS.

an outer hose, leading to the spraying nozzle, are connected, respectively, with the outer ends of the tubes. The nozzle has a longitudinal duct for the passage of air and another for the passage of liquid, both controlled by a plug valve so arranged that when one duct is fully open the other is almost closed, the valve being operated by the handle shown. As the operator holds the nozzle in one hand and works the pump with the other, the air forced into the tank agitates the spraying liquid, and the pressure forces out the liquid and a regulated portion of air to mix therewith and form a spray, the entire shutting off of the air, with the use of the proper nozzle, giving a solid stream. The invention provides for the employment of modified forms of the valve and nozzle.

A STOVE AND OVEN FOR "CAMPING OUT" PARTIES, PROSPECTORS, BOATING, HOUSE USE, ETC.

The accompanying illustration represents a portable cooking apparatus especially designed to promote the comfort of parties camping out, and which can be readily packed in small compass, as shown in Fig. 1, for convenient storage or carrying. It has been patented by Dr. W. E. Baxter, of Frankfort, Ky., whose camping outfits, in the line of cooking and service utensils, have attained considerable reputation. Fig. 2 shows the apparatus ready for use, the oven being in place for baking, and Fig. 3 represents the oven sepa-



BAXTER'S PORTABLE STOVE AND OVEN.

rately, its under side turned up to show holes for gas burners, as the stove and oven can be used with any kind of fuel. In camp, fagots or wood will be used, but as a serviceable stove for the house, for summer cooking, gas, wood or charcoal may be most efficiently employed. The stove is approximately $10 \times 12 \times 18$ inches, and is made of 18 gage smooth sheet steel, the oven being made of 24 gage and large enough to accommodate two 9×16 inch bread pans or to roast one turkey. The ash pan fits in the bottom of the stove, and a perforated grate has side flanges which fit alongside the pan and rest on the bottom of the stove. The oven has an outer casing and an inner shell, the latter being made smaller than the casing to provide space for the passage around it of the draught, heat and smoke. A damper in the oven controls the passage of the heat, and is made wide enough to close the space between the inner and outer shells. The stove is also efficient as a heater, or for cooking other than baking. The pipe is telescopic, and is made so that any four inch pipe, to be had at the stores, will fit it, and can be adjusted to any tent, boat or house. The oven can be packed with an outfit, cooking and serving (invented by Dr. Baxter) for six people. This invention attracted much attention at the Sportsmen's Exposition, last March, at Madison Square Garden, New York City.

Phosphorescence of Ozone.

M. Marius Otto has just discovered an experimental fact, says La Nature, that was described recently in his name before the Academy of Science by M. Friedel, and that may be productive of important results. This fact relates to the phenomena of luminescence to which ozone gives rise in special conditions. The fact was observed for the first time during the aspiration of ozonized air by means of a water aspirator. The light took its rise at the point of contact of the water and the ozone, and the water remained luminous for five or six seconds after issuing from the aspirator, so that a flask filled with this luminous water and taken into a dark room could be followed distinctly. The experiments were made with ozonized oxygen containing 40 to 50 milligrammes of ozone to the liter[about ½ grain to the quart] and made with ozonizers invented by the author. It seems that the luminosity thus produced by the contact of ozone and water is due to the presence, in the latter, of organic matter of animal or vegetable origin, and that most organic substances are able to produce, with ozone, phenomena of phosphorescence. This is, then, a very particular and very ineresting case of low temperature combustion, and a new example of the production of cold light.

THE Medical Record says eggs are useful in the following applications: A mustard plaster made with the white of an egg will not leave a blister. A raw egg, taken immediately, will carry down a fishbone that cannot be extracted. The white skin that lines the shell is a useful application to a boil. White of egg, beaten up with loaf sugar and lemon, relieves hoarseness, a teaspoonful taken once every hour. An egg in the morning cup of coffee is a good tonic. A raw egg, with the yolk unbroken, in a glass of wine, is beneficial for convalescents.

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A DESTRUCTIVE THUNDERBOLT.

A rather curious thunderstorm visited the neighborhood of Whitby the other week. There were only two loud thunderclaps, accompanied by two flashes of lightning. The first stroke caused the destruction of a large oak tree in the park of Mulgrave Castle and the second damaged rather seriously a farmhouse in the village of West Barnby, about two miles distant. In the case of the oak tree the electric current seems to have run upward. The ground for several yards was torn up, and the large root of the tree was ripped in pieces. For a circle of a diameter of 160 yards the ground is littered with heavy pieces of bark and wood, in some cases split into ribbons. We are indebted for our engraving to Black and White.

EFFECT OF LIGHTNING ON OAK TREE.

PETROLEUM WELLS IN THE SUBURBS OF LOS ANGELES, CALIFORNIA.

The discovery of petroleum within the city limits of Los Angeles, California, has so transformed one of the suburbs of that city that as a remarkable spectacle there is nothing to compare with it in any city in the world. The accompanying illustration is reproduced from a photograph taken in one of the outlying suburbs, in which, some three or four years ago, a profitable oil-bearing stratum was discovered. The fact that the oil underlay a thickly settled territory, where most of the land was divided into fifty foot lots, naturally made each landholder anxious to secure the oil before it should be drawn up by his next door neighbor. The consequence was that wells were driven with all possible speed, and a picturesque residential district was very quickly covered by the huge, unsightly derricks and tanks which are to be seen in the engraving. Every consideration gave way to that of securing the valuable oil, and, as a consequence, the pretty cottages with their surrounding lawns and shrubbery were soon incongruously intermingled with all the unsightly paraphernalia of hundreds of modern drive-wells. In his hurry to secure the oil the owner of a little 50 by 150 foot lot in some cases erected as many as five derricks within that area. Naturally this haste to grow rich defeated its purpose, and after a year or two the wells began to decrease in yield. Some of them, it is true, began to yield again later to a limited extent, while other wells have been abandoned altogether Of course the work of recovering the oil might have been done more economically if the property owners of half a dozen lots had combined to sink one well between them, instead of sinking two or three wells to each lot, as they have actually done. In some cases, after the first exhaustion, the wells were sunk to a greater depth, with the result that a further flow was encountered.

Petroleum has been produced in California for many years, and the oil fields seem to extend throughout the whole length of the State, as indicated by the frequent oil croppings. It is only in the southern counties, however, that there has been any development of the industry, and this has been confined mainly to the counties of Ventura, Santa Barbara and Los Angeles. The discovery of oil in Los Angeles has naturally created quite a boom in the industry, and prospectors are busy in other sections of the State.

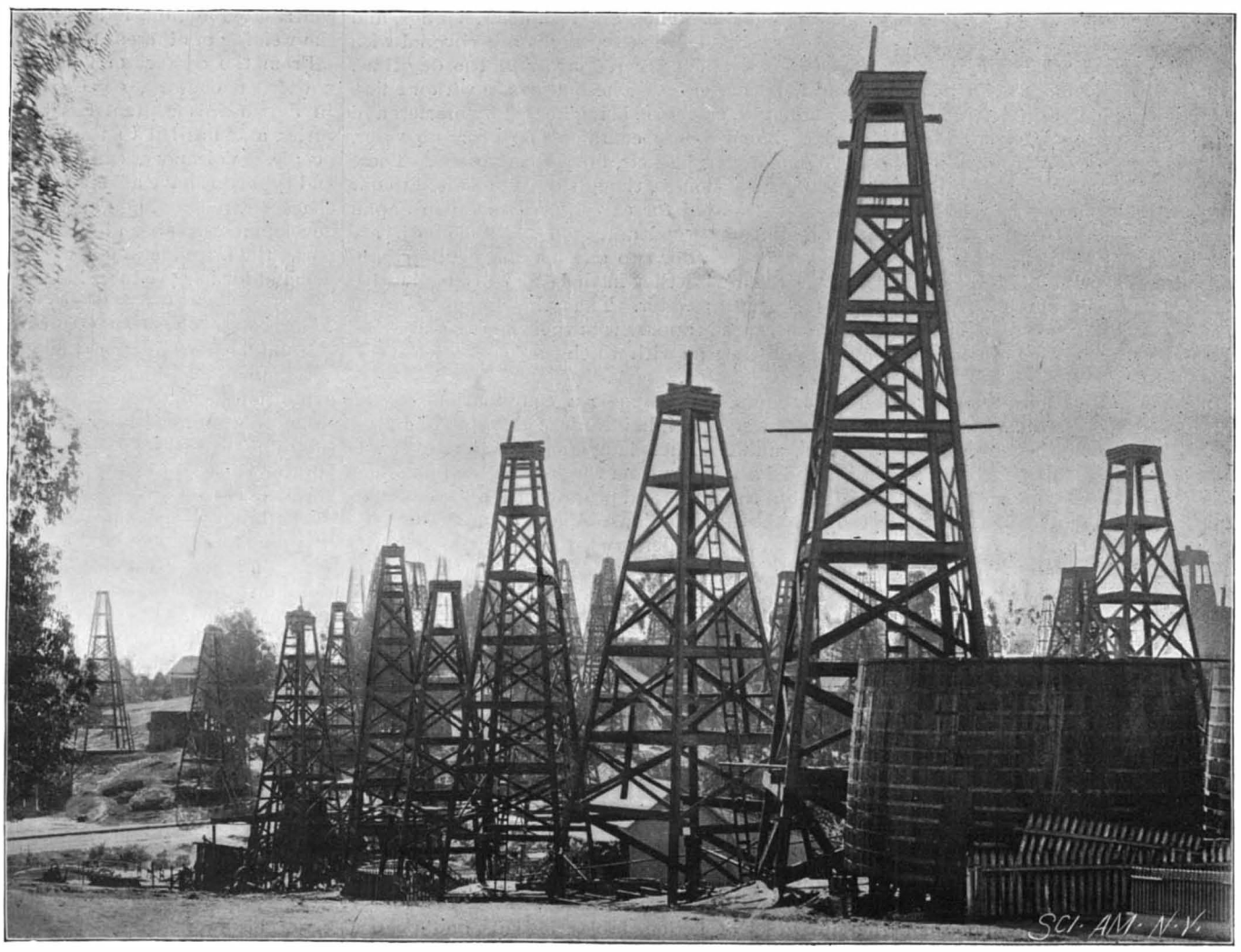
The early Mexican residents of Los Angeles were aware of the fact that there was petroleum in the formation underlying the city, and they used the asphaltum residue of the oil which they gathered at the outcropping for roofing their adobe houses. In those early days the commercial value of the oil was unknown, and the Mexicans made no attempt to utilize it. The first boring for oil was made about four years ago at a point about one mile west of the business center of the city, and since then over five hundred wells have been sunk within the city limits and within an area which extends over a mile east and west and about 600 feet north and south. During the past nine months new wells have also been sunk with a fair measure of success about half a mile beyond the eastern limit of the producing field above mentioned.

The Los Angeles oil differs from that of Pennsylvania in that it has an asphaltum instead of a kerosene base, and is not suitable for illumination. It is thick, and black in color, with a low specific gravity, and it is said to be the best fuel oil that has ever been discovered. It is used for the manufacture of lubricants, paints, printing ink and various other commercial products. The cost of sinking a well varies considerably, but $1,200 to $1,500 may be taken as the approximate cost for a well 800 feet deep.

As was to be expected in a new industry such as this, there has been a considerable fluctuation in the price of the oil in Los Angeles. It was first sold for about $2 per barrel of 42 gallons. The price began to fall rapidly, until it reached as low a figure as 35 cents per barrel. A Co-operative Oil Exchange was then formed, and this, together with the increasing use of the oil in factories and by some of the railroads, brought the price up to $1 a barrel, delivered at the well. At this figure it remained until the spring of this year, when the increased demand caused the price to rise to $1.50 at the well, at which figure it now stands. At this rate it is considered to be a cheap fuel in comparison with coal. A ton of soft coal is reckoned to be equal as fuel to three barrels and a half of oil, which would make the equivalent cost of coal in Los Angeles about $5.50 per ton, at the factory. At this price it is considered that Los Angeles manufacturers should be able to compete with those in the East. The daily yield of oil is from 4 barrels a day in the older wells to 40 barrels a day in those which have been recently bored at the western edge of the field. At the present price, this represents a total output valued at $1,250,000 per year.

It was natural that the development of these fields within the city limits should meet with considerable opposition from citizens who object to see the suburban section of Los Angeles rendered hideous by such a forest of grimy derricks as are shown in the accompanying illustration, and the opposition has been particularly strong since wells have been driven in the direction of the handsome residence section surrounding Westlake Park.

The city council has very wisely passed an ordinance forbidding the boring of wells within 1,600 feet of this park, and it is likely that the disfigurement of the city will be confined to the strip of land to which reference is made above.



AN OIL FIELD IN THE SUBURBS OF LOS ANGELES, CALIFORNIA.

The Borghese Treasures.

Ever since the bankruptcy of the Borghese family in 1892, art lovers have been afraid that this collection, which is one of the most remarkable in the world, would be dispersed, but it is now announced that the Italian government is to pay 6,000,000 francs, about $1,200,000, for the pictures and statues in the museum, while the city of Rome will pay about $600,000 for the great villa and the park which the museum occupies. Now not only will the collection be kept intact, but the villa, which is perhaps the finest of the old Roman villas built by the popes, will also be preserved. The building speculation which ran riot in Rome a few years ago has already destroyed too many of the lovely palatial villas, and it is a satisfaction to have one of them kept from despoilment. The park, which consists of a large tract of rolling meadow and woodland, exhibits in perfection the unsurpassed beauty of Italian landscape art. It has little of the formal gardening of the Villa Medici, and more nearly resembles a great English estate wherein nature is left much to herself. But added to this perfectly free and easy treatment will be found the beautiful ilex trees and stone pines, with here and there an avenue of cypresses. In the villa is preserved the great collection which the government has just bought. The Borghese collection was first formed by Marco Antonio Borghese before 1800. His son, Prince Camillo Borghese, married Pauline Bonaparte, the sister of the Emperor Napoleon, and in 1806 sold to his brother-in-law the most valuable of his treasures, which now adorn the Louvre. Afterward he gathered the new collection which the Italian government has just prevented his descendants from getting rid of. None of the antique marbles are of very great importance, but in modern statuary and pictures the gallery is exceedingly rich. Indeed, it is generally believed to be the most valuable private gallery in the world; it is certainly the most valuable private collection of Italian masters in the world. Perhaps the most famous of the pictures is Titian's "Sacred and Profane Love," and Correggio's "Danae," after its long wanderings, here finds a home. Raphael is represented by the "Entombment," which has a very interesting history. There are other pictures by Sodoma, Fra Bartolomeo, Andrea del Sarto, Francesco Francia, and many others. The decadent masters of the High Renaissance are probably better represented here than elsewhere.

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The Japanese Nation—A Typical Product of Environment.

Mr. Gardner G. Hubbard, in a lecture in the assembly hall of the United States National Museum, Washington, D. C., recently gave some very interesting particulars regarding the Japanese nation. In brief, he said of all countries of the earth, none have made such wonderful and rapid progress in the form of government and in the development of industries and commerce and such changes in its conditions of environment as Japan. This country, which, twenty-five years ago, was almost unknown, has come forward to take its place not only as the foremost of Oriental powers, but in the sisterhood of nations. A glance at her geographic position, her internal and industrial resources, a brief study of her past history and the character, manners, and customs of her people, will help us to understand her present, and perhaps foretell something of her future. Both the old and the recent development show Japan to be a typical product of environment.

In the geographic position of Japan and Great Britain there is a striking resemblance, both consisting of a group of islands with an extensive sea coast indented by excellent harbors, their insular position protecting them from invasion by land and offering every opportunity for commercial intercourse. Almost within sight of each lies a continent densely populated, affording a market for productions and manufactures; both are rich in mines, coal and iron ore. The mines of Japan are developing her manufactures and her commerce, and she must become the first commercial power of the Orient. The empire of Japan is composed of four large and three thousand small islands, forming an arc of a large circle extending from the northeast within a few miles of Kamchatka, southwest about two thousand miles, and with Formosa, nearly three thousand miles, from an Arctic climate to one of perpetual spring and everlasting summer. A long range of high mountains follows the general trend of the islands, culminating in Fuji-yama. The rapids, streams, and inland seas contribute to make Japan a nation of sailors. The oldest existing race in Japan is the Ainos, who now occupy the northeastern islands. They originally occupied the greater part of Japan, but were gradually dispossessed of their land and were driven far north or enslaved and so gradually intermingled with the subsequent immigrants who came from the islands of the Pacific, China, Corea, and Mongolia. The southern portion of Japan became inhabited by people of the Malay and Polynesian type. Into the center came the Coreans and Chinese, while into the north came men of the Mongolian type. The habitable portions of Japan are on or near the shore. This gives easy communication by water to all parts of Japan, and has led to the mingling of its races and the formation of the Japanese nation.

In former times the Mikado, as the earthly representative of the Deity, ruled with absolute power, but by degrees the Mikado and his court became weak and the real power passed from the court and civil rulers to the army. The military officers gradually withdrew from court to fortified camps and subsequently built castles where they lived, surrounded by retainers. They embodied in their customs and mode of life most of the features of the feudal system of Europe. Japan is greatly indebted to this for subsequent development, for each castle became a center of civilization and of independent growth.

The merchants of Europe had commercial relations with Japan for seventy-five years between 1550 and 1625. With the traders came the Jesuits. This contact with European civilization wrought important changes in Japan, though not perceptible to us. During the last part of the sixteenth century persecution began, until the Christians had all either renounced their faith or been put to death. This attempt to establish commercial relations with Europe, and to introduce Christianity, resulted in the sealing of Japan against all communication with the outside world for two hundred years. Finally a few Japanese became desirous of seeing more of the foreigners, and about the middle of this century the Mikado, a man of greater ability than his predecessors, determined to recover the power formerly wrested from his ancestors. It was about this time, 1853, that Matthew G. Perry, commander of the naval expedition of the United States, visited Japan and demanded the opening of certain ports to American commerce. Next year he returned and renewed his demands. England and other European powers immediately followed and compelled Japan to make treaties with them. The ports were opened in 1859 and 1860, but it was only by slow degrees that western civilization was brought to Japan and the barriers to intercourse and progress removed. The Mikado now slowly recovered his old powers, and the old Japan passed away. A commission of the highest nobles was sent to the United States, Germany, England, and France to study their systems of education, finance, justice, religion, and the organization of their armies and navies. Japanese youths were sent abroad for education, and men of high reputation were brought from other countries as professors and teachers. Their financial and educational systems were modeled on those of the United States, Germany, and England. Their judicial system was borrowed from the code of half the nations of Europe. Their navy was patterned upon the English, their army upon the German system.

In 1871 the Mikado overthrew the feudal system, and freedom was given to the serfs; in 1872 education was made compulsory; in 1876 Sunday was adopted as an official holiday and all acts against Christians were repealed, and in 1877 an edict was issued forbidding the Samauri to wear the long and short sword, which resulted in the passing away of the order.

In 1889 the Emperor gave a written constitution to the people, limiting his own powers and establishing a parliament with a representative form of government. The reorganization of the government and the compensation to the nobles resulted in a large debt, which has been considerably reduced. The paper money, formerly at a heavy discount, is now redeemed at par. Taxes, formerly unknown to the people, were imposed and increased from time to time by the government, but by the breaking out of the war with China all opposition to the government was changed to patriotic feeling, and all classes joined in support of the Emperor.

Another cause which contributed greatly to the making of Japan into a nation is its good roads, which have been for a long time better than in most other countries. The first railroad was constructed in 1870; now between two thousand and three thousand miles are in operation. These are largely patronized, the travel increasing every year; other roads are in process of construction. A few years ago many Japanese substituted the European dress for the Oriental, as an evidence of civilization; they soon realized that it was unsuited for Japanese life and that its adoption would lead to the introduction of western domestic customs and the abandonment of their ancestral habits. A reaction followed and they generally decided to retain their own dress. In the army, navy, police, and in business houses fashioned on foreign models, the European dress has been adopted as most convenient. Although required in court circles, some officials who are compelled to wear the European dress take it off as soon as they return home. One very wealthy nobleman occupies a double house—one half his Japanese home, the other furnished in the French style, where he receives foreign visitors and officers of the court. The Japanese houses usually receive light and air, not from the street, but from small courts or gardens in the rear. The entire side of the house on the garden is movable, so that the interior can be thrown open to the day and sunlight. Houses are usually small and low, and are from six to eight feet in height. The partitions are wooden panels three feet wide and sliding in grooves in the floor and ceiling and covered with paper. Neither paint nor varnish nor finish is used about the house. Instead of windows they have screens covered with thin white paper, protected on the outside by sliding shutters. As the people sit upon the floor, they have no need of furniture. For seats they have mats all of the same size, and upon these mats the people eat, sleep, and die. They are bed, chair, lounge, and table combined. The mats at night are covered with wadded quilts, which are put away in the day time, and on these they sleep. The houses are without fireplaces, chimney, or smoke, being heated by braziers and charcoal. Every house contains one or more vases, and often hanging baskets, filled with flowers. These typical Japanese houses, though quite unsuited to our life, are better fitted for earthquake shake in Japan than buildings of wood and stone. Public baths are universal; for a cent or two one may have a hot bath, while for the house they have bath tubs made with ovens for heating water. That the Japanese are a most cleanly race is apparent in their houses and workshops and in the care with which they look after everything in their charge.

The Japanese language is a combination of the tongue of the ancient inhabitants of the islands, and is, therefore, unlike other languages. Literature was introduced into Japan from China with the religion of Buddha, but the words and pronunciation have been so softened to fit the melodious Japanese tongue that the Japanese cannot understand the Chinese, nor the Chinese the Japanese. As a large proportion of the Chinese characters are used, it is not difficult for the Chinese and Japanese to communicate by writing. The difficulty of learning to write the Japanese language is very great, as, in addition to the Japanese alphabet, some fifteen thousand to twenty thousand Chinese characters must be memorized, and the eye and hand trained to distinguish and delineate them. An American started the first newspaper, in 1871, with twelve hundred characters, but was compelled to increase them, and now uses twelve thousand. In the printing office each compositor sits at the desk, with the letters of the Japanese alphabet within his reach, while boys bring the Chinese characters from their numerous places for him to set up. The Japanese literature is rich in works of fiction, fables, legends, and poetry, and as they are generally written in Japanese, they are largely read by the common people.

The mythology of Japan abounds with beautiful, romantic, and weird stories, the foundation of much of its art and poetry. As the intellectual progress of the people, their art and literature, were developed, the need of a religion higher and more spiritual than Shintoism—as their old religion was called—was felt. This was found in Buddhism, which came from China in the sixth century. The influence of this religion was not confined to the daily life, but acted upon the literature and art. For a time it seemed as if Buddhism would supplant Shintoism and become the religion of Japan, but instead of that it elevated and spiritualized Shintoism, so that it regained much of its hold upon the people.

The art of the Japanese differs from the Aryan or Indo-European, for it is not, as with them, the grafting of one style upon another, but the accumulated knowledge of many centuries, unaffected by foreign influences. Within its confined scope it was in advance of the art of other nations when the country was opened to foreigners. After the introduction of art, its development was greatly promoted by the influence of the feudal system. Pictorial art has never attained any great importance, but the decorative and industrial art of Japan is original and excites the admiration of the world. They know little of either sculpture or music in their highest development, and their delineations of the human form, though showing skill, are only bizarre and grotesque; but they have the closest and most sympathetic appreciation of nature in a most delicate and beautiful aspect, and their exquisite representations of the varied forms of animal, insect, and plant life make their work the wonder and envy of our western artists. In porcelain, pottery, and lacquered ware, and in metals and bronzes, the Japanese have never been surpassed; but in the increase of the demand the individual workman is giving place to men and women crowded together in factories, using machinery, where the personality of the workman disappears.

The Japanese have always been a warlike people, and in January, 1893, before the Japan-China war broke out, Japan had an army which, though small, would not have done discredit to any of the nations of Europe in organization, discipline, and equipment. In actual fighting strength it had between sixty and seventy thousand men, with power to call a much larger reserve force into the field.

The position of Japan, with its inland seas, good harbors, early led them to become good sailors. As a result of this, the fleets of China either lie at the bottom of the ocean or fly the flag of Japan, enrolled in its navy. The campaign was all as well planned and carried out by Japan as the campaign of Germany against France, in 1870. The war was the contest of civilization against barbarism, of intelligence with ignorance. Japan is not only the foremost nation of the East, but her civilization compares, in every way, favorably with that of Europe. They are the French of the East, and Japan as a nation possesses an individuality stronger than our own.

Japan is indeed a typical product of environment. A warm climate, where the land and water not only contribute food, but induce continued intercourse and the welding of different races into one nation.

From the contact of man with man, from city life, not from country, comes the highest civilization. In Japan this contact has been maintained for centuries, and has led to the steady development of her people. Volcanoes, earthquakes, mountain torrents, and typhoons have affected not only the land but the character, religion, and art of its inhabitants, while its development has been hastened by the opening of the ports, the introduction of western civilization, and the demand for her products in every market of the world.

The Exhibitions of 1896.

It will be remembered that in 1896 exhibitions were very much overdone. It was easy to count a dozen exhibitions, some say sixteen, and by reckoning every show, this number might, no doubt, have been considerably exceeded, says the Trade Journals Review. On the whole, the exhibitions did not do well. A few statistics which a German journal compiles or reproduces forcibly bring out some of the reasons. The great traveling public cannot be everywhere: thus a town which indulges in the big advertisement of an exhibition must to a certain extent rely upon its own citizens as safe visitors. The maximum daily attendance was 130,000 at Berlin, 67,000 at Budapest, 50,000 at Nuremberg, 35,000 at Geneva, 45,000 at Dresden (art and industry), 15,000 at Stuttgart, 27,790 at Nijni-Novgorod, and 14,540 at Kiel (fisheries). The comparative figures are: Vienna (1873) 139,070, Paris (1889) 402,000, Chicago 71,888 daily visitors. If the attendance of the above exhibitions had been made up of the respective citizens alone, the citizens would have to put in appearance a good many times. We give the numbers and add the percentage of the population which actually passed the gates daily: Berlin, 3·5 times, 2·8 per cent; Budapest, 5·6, 3·36; Dresden, 4·4, 4·4; Nuremberg, 13·5, 8·76; Novgorod, 6·6, 5·2; Stuttgart, 7·4, 6·02; Geneva, 28, 16·4; Kiel, 12·8, 9·4. How these figures were ascertained we cannot say. And yet 1897 will be quite as much an exhibition year.

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Science Notes.

A bill to legalize the use of weights and measures of the metric system is now before the House of Commons.

Rhinometers are devices to measure the amount of air a man breathes through his nose, in order that his doctor may compare it to the amount he should take in that way.

Dr. Charcot's statue, by the sculptor Falguière, is nearly finished, and will soon be erected in the Salpetriere Hospital, where Charcot made his experiments on hysteria and hypnotism.

Newfoundland has issued a series of Cabot postage stamps to celebrate the four hundredth anniversary of his discovery. One of the designs used are portraits of Cabot and Henry VII and scenes of Newfoundland life.

Konakry, on the west coast of Africa, has been reached by a French expedition in three weeks from the Niger, for the second time. This establishes the advantage of the route by way of Fula-Djalon, and surveys for the road are being hastened.

A dispatch from Danes Island, dated June 28, announces that the filling of Prof. Andree's balloon was completed on June 22, and everything was ready to start in his attempt to cross the Arctic regions on July 1. The winds have been hitherto chiefly northerly.

Neapolitans have a bad reputation for ill treatment of animals, and the Naples S. P. C. A. seems to have plenty to do. During last year its agents stopped 44,321 carts for carrying too heavy loads, and in nearly one-half the cases had the load reduced; they confiscated 41,011 sticks used for beating animals and 887 spikes used on curb chains; 2,282 convictions for cruelty were obtained.

In connection with the "Diamond Jubilee," Mr. William Crookes and Dr. Gowers received knighthoods. The Order of the Bath was conferred on Mr. Wolfe Barry, President of the Institution of Civil Engineers, Dr. Frankland, Dr. Huggins, Mr. Norman Lockyer, Dr. Thorne Thorne and Admiral Wharton. Minor honors were conferred on a number of scientific men of the kingdom. The selection of Mr. Crookes for knighthood was very appropriate.

Mr. Frank M. Chapman, of the Museum of Natural History, compiled a list of the birds which he saw on the hats of women recently in New York City, during two afternoons. Forty species were represented. In all he saw 173 wild birds, or parts of them, on hats. Of these birds, at least thirty-two varieties are protected by law during all or a major portion of the year. A Boston court has just decided that it is unlawful to wear feathers of a bird that is protected by law, and a similar law exists in New York State.

In a recent number of the Gardeners' Chronicle, Mr. G. J. Burch contributes an interesting article, accompanied with figures, upon the use of the X rays for photographing flower and fruit buds. Mr. Burch and his assistants began by exposing plates of glass of different colors to the action of the rays. The violet glass showed itself much more opaque than that of other colors. It contained alumina and cobalt in addition to the ordinary elements. An experiment was afterward made with a violet-colored hyacinth, and, as had been anticipated, the flower gave different results from those given by the glass. It was much more transparent. The sensitized plate, after development, showed that the contour of the petals, the veins, and the internal form of the ovary were well represented. For taking such radiographs Mr. Burch advises the use of tubes that give very little light, and that, for example, would scarcely give the contour of the hard parts of the hand. The aeriferous tissues are very transparent to the X rays. The more water the tissues contain, the more opaque they are. Dry fruits and flower buds give excellent radiographs. The seeds are very distinctly seen, as are also the different parts of the flower.

In north latitude 70° 40′ 11·3″, where the most northerly town in the world, namely, Hammerfest, is situated, there is a monument which was visited by most of those who went to Norway to obtain a view of the total solar eclipse. This monument consists of a fine granite pedestal and pillar supporting a large terrestrial globe made of copper, and was placed there to commemorate the completion of a grand piece of surveying work. The primary object of this survey was, as Mr. Fowler writes in an interesting article in Knowledge (June), the measurement of the earth, and to provide a permanent mark in order that the measurements may be repeated at any future time if considered desirable. Without entering into the details of a trigonometrical survey, and how a triangulation is accomplished, we will limit ourselves to the inscription, written in Latin and Norwegian, on the pillar, referring the reader to the article in question for details: "The northern termination of the arc of meridian of 25° 20′ from the Arctic Ocean to the river Danube, through Norway, Sweden and Russia, which, according to the orders of His Majesty King Oscar I, and the Emperors Alexander I and Nicholas I, and by uninterrupted labors from 1816 to 1852, was measured by the geometers of the three nations."

THE DENUDATION AND RECOVERY OF FARM LANDS.

One of the most useful of the Farmers' Bulletins issued under the administration of the present Secretary of the United States Department of Agriculture is that entitled "Washed Soils: How to Prevent and Reclaim Them." We reproduce in this impression three illustrations which accompany the paper, showing the effects of erosion and how to remedy them. The denudation or washing of lands in the higher levels of the earth's surface has been one of the most important factors in the geological changes which have so modified the surface of the earth. As a rule, this denudation is exceedingly slow, and the general level of large tracts of country is not lowered more than an inch or two in a hundred years; but when it is excessive, and more rapid than the natural decay of the subsoil material which is exposed, it may work serious injury to agricultural lands.

The excessive erosion or washing of lands may be prevented, the fields already cut up with gullies and watercourses may be recovered, and steep slopes may be held and prevented from washing by chemical means; by cultivation and under-drainage; by reforestation; and by grass and similar vegetation.

I.—CHEMICAL RELATIONS OF THE SOIL TO SURFACE WASHING.

Surface erosion can be largely prevented by such a system of cultivation and cropping as will introduce as large a quantity of organic matter into the soil as possible. A very old method of recovering washed and gullied lands is to place straw in the furrows while plowing, the straw not only acting mechanically to hold the soil in place and prevent surface erosion, but also in a very efficient way to increase the quantity of humus, thus making the soil hold large quantities of water which otherwise would have passed off over the surface.

As soon as a sufficient supply of humus has been accumulated and the lands are brought up to an adequate condition of fertility, clover or grass should be seeded, if the land is at all suited to these crops, or rye, oats, or field pease should be sown to help hold the surface.

A soil containing a fair supply of lime is much less liable to wash than one similarly situated and exposed which is deficient in lime. Clays which are heavily impregnated with lime salts are in a flocculated state, the fine grains of clay being held together and in contact with the larger grains of sand. This flocculated mass quickly settles and is originally not so easily disturbed and carried off by moving water. A stiff clay soil is practically impervious to the penetration of surface water when it is delivered in such torrents as we are liable to have in our summer storms. A well limed soil, on the contrary, although it may contain as much clay but in which the particles are flocculated or drawn together, is much more pervious to water, and the amount of water which the soil will carry down through under-drainage is increased, and the excess which has to flow off over the surface is diminished.

II.—WASHING OF LANDS MAY BE PREVENTED BY METHODS OF CULTIVATION AND UNDER-DRAINAGE.

A field in a condition of fine tilth and plowed to a depth of 10 inches will hold 2 inches of rainfall and absorb it very readily, and a soil in such a condition will suffer no surface washing from any ordinary rainfall. This will not only save the surface from being washed and gullied, but it will also increase the store of moisture held by the soil, which is of very great value in the time of drought.

It is important also for this, as for other reasons, that the soil be covered with vegetation as much as possible throughout the year, as the roots and organic matter serve to bind the grains of the soil together.

Another very effective method, when properly carried out, to prevent the washing of lands is to underdrain the soil with tile or other drains. These drains carry off quite rapidly an excess of moisture, so that much more of the rainfall is absorbed by the soil and carried off through the drains and less washes over the surface of the land.

In cases where these methods may not be sufficient it will be necessary to provide for a more uniform distribution of the flow over the surface, and to prevent any accumulation of water which would have the effect of a torrential stream. This is secured in a great measure in cultivating the soil by laying off the rows according to the contour of the surface, so that each row will have a very slight incline of not more than from 1 to 6 inches in 100 feet, in which the flow of water would be so slow that there would be little or no erosion.

To prevent an accumulation of water from breaking down the rows larger and more substantial ditches may be provided, following very nearly the contour of the field, so that there shall be a fall of from 1 to 6 inches in 100 feet. The distance apart of the ditches will depend upon the slope of the field; with a very steep slope they should be close together, often not over 6 to 10 feet apart; with a gentle slope they should be at intervals of 15 or 20 feet, or even farther apart, depending upon the texture of the soil and the contour of the surface.

These sidehill ditches are very easily constructed, being made almost entirely with the plow. It is well to get the bank forming the lower side of the ditch sodded with grass to help hold it and to lessen the danger of its giving way during a heavy rainfall. Unless these ditches are thoroughly constructed they are worse than useless; for if they break they concentrate a volume of water upon one point in the field which would otherwise have been distributed over the surface, and this often forms a torrent which does great damage. They should always be run with a level, of which there are several forms on the market suitable for this work.

A more efficient, but at the same time much more expensive, method of preventing the washing of lands where there is a considerable slope is to terrace the fields so that there shall be level steps upon which the water can rest for awhile and be absorbed.

III.—RECOVERING GULLIED HILLSIDES BY REFORESTATION.

Forest ground is not subject to this erosive action of the rainfall, because in a forest a large part of the rainfall never reaches the soil, as 20 or 30 per cent is intercepted by the foliage and evaporated before it reaches the ground. The rainfall which reaches the surface is rapidly absorbed, as the soil is kept granular and loose and much more of the water is carried off by under-drainage rather than by surface drainage.

Just as deforestation of hillsides and hilltops is the first cause for inducing erosive action, so is reforestation the most effective means in curing the evil. This has been demonstrated in France, where the government and the farmers together have spent, during the last thirty years, over $40,000,000 and expect to expend three or four times that amount to reforest 1,000,000 acres of denuded mountainsides, the soil and debris from which has been carried by the torrents of water into the plain, covering over 8,000,000 acres of fertile ground and making it useless for agriculture. Sodding for pasture has been found mostly less effective and on the steeper slopes entirely ineffective.

Wherever the ground in the hill country is not fit for agricultural use it should be set and kept in forest, not only to make it produce a timber crop, but also to prevent the erosion which finally becomes dangerous to the lower valley lands. The forest should occupy all hilltops which, as a rule, have too thin a soil to allow profitable agricultural use; it should be kept growing on the steeper slopes where the water acquires the greatest momentum and the loosening of the soil by the plow furnishes a most favorable condition for erosive action; it should be placed on all rocky, uneven, agriculturally useless spots, because it will produce useful material even on such unfavorable situations, and, finally, forest belts should be maintained on long slopes alternately with fields and pastures, running along the brow of the slope of widths and at distances proportionate to the character of the land and the angle of the slope—on the steeper slopes closer together, on the gentler slopes further apart. In the deeply gullied hill lands, where plowing is impracticable, it is necessary to break the force of the water by constructing brush dams across the gullies, as shown in the second illustration, and roughly fill in the latter with stone, gravel, earth, etc., in front and rear if they are shallow, and at least in the rear if they are deeper. Where the ravines are especially deep and wide it may become necessary to supplement and strengthen the rough dam with a loose rubble embankment or a dry wall of stone. A simple and efficient method has been practiced in France, which consists in filling up the ravine with brush placed lengthwise and keeping this down by poles laid across and fastened in the sides of the ravine. The waters are thus allowed to drain off, while the soil carried by them is retained in and over the brush, and in a short time the gulley will fill up of its own accord. Then alders and willows are planted along the edge and soon finish the work of securing the ravine against washing. The means for thus breaking the force of the water in the gullies and changing it from a rushing torrent into a series of gentle falls, and in part from surface drainage into subterranean drainage, and of filling up the gullies themselves will have to be devised in every special case as circumstances permit and the ingenuity of the operator suggests. The brush dam is preferably made of willow, poplar, alder, or other readily sprouting material, which becomes alive and, by striking root, adds to the firmness of the dam.

PLANTING.

To cover the soil as quickly as possible with a dense and permanent arborescent cover is the object to be attained. Where the soil has not been so far eroded that plowing could be done, it might be best for the first season to sow oats, field pease, or other crops that will readily grow and make a cover. The cheapest and most readily germinating tree seed should be looked for and the quantity used per acre should be lavish, to secure a dense stand from the first. The most readily available kinds are the silver or red maple, box elder, elms, ash, and black locust; and since for various reasons variety or mixed woods are preferable, it is advisable to use as many kinds as can be readily obtained.

Where the ground is too much cut up and too uneven

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to permit of plowing, recourse must be had to sowing of seed in plats, or planting of seedlings or cuttings by hand. This is naturally much more expensive, and therefore should be done with greater care and foresight. Plats may be made by loosening the soil with a hoe or spade, and sowing the seed into these seed beds, covering the seed only slightly. The plats should be three to four feet apart to make sufficiently rapid cover.

The cheapest and most readily growing material for the general cover is furnished by the willows and poplars, to which may be added the box elder, the black locust, and the catalpa, while other more valuable kinds may be introduced, when the first cover has been established, by the planting of two or three year old plants in single specimens.

The first and principal object being to break the force of the surface waters, the arrangement in setting out the plants should be as nearly as possible in horizontal and parallel rows along the brow of the hill, following the contours. To get a full cover as soon as possible, the plants should be set not farther apart than three to four feet and even less, making from 5,000 to 7,000 per acre. If this is found too expensive, or for some reason impracticable to be done at once, the work may be reduced and divided into several seasons; the rows then may be made farther apart, say from six to sixteen feet, according to the slope, and the plants in the row two feet, when the number will be one-half, or less.

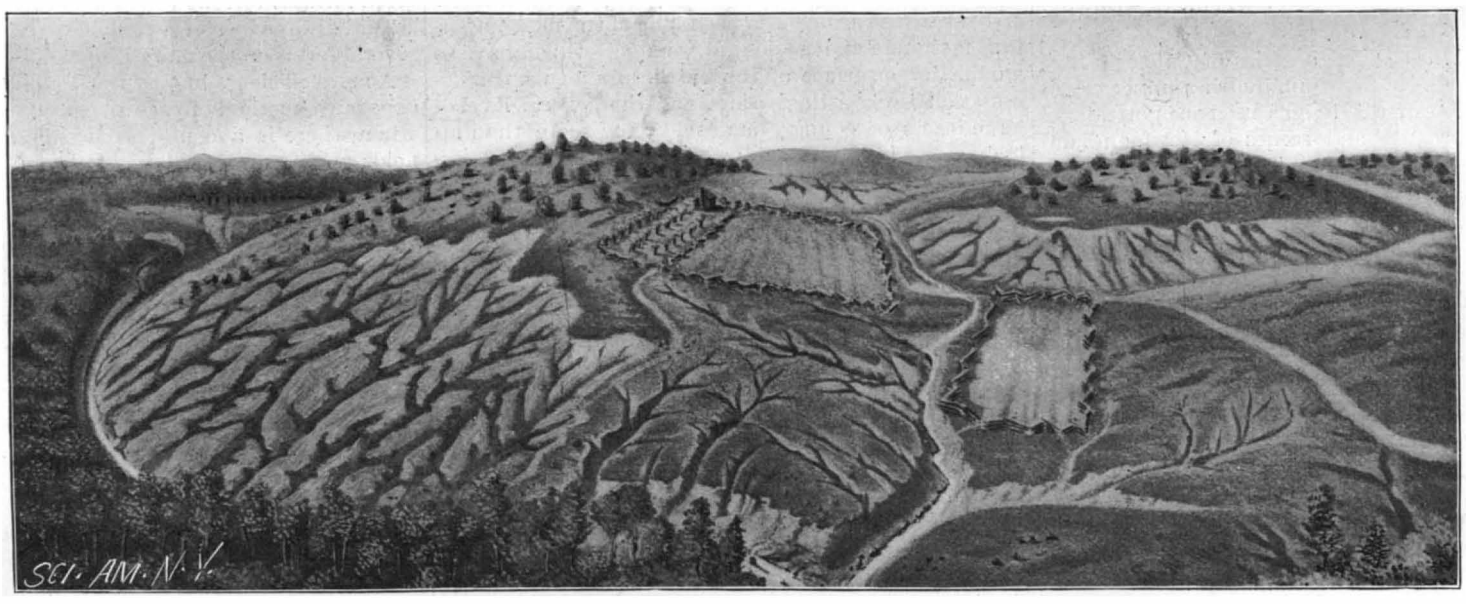

Fig. 1.—HOW THE FARM IS LOST.

Cutting off the timber allows surface water to rush rapidly over the ground, washing away soil and cutting surface into gullies.

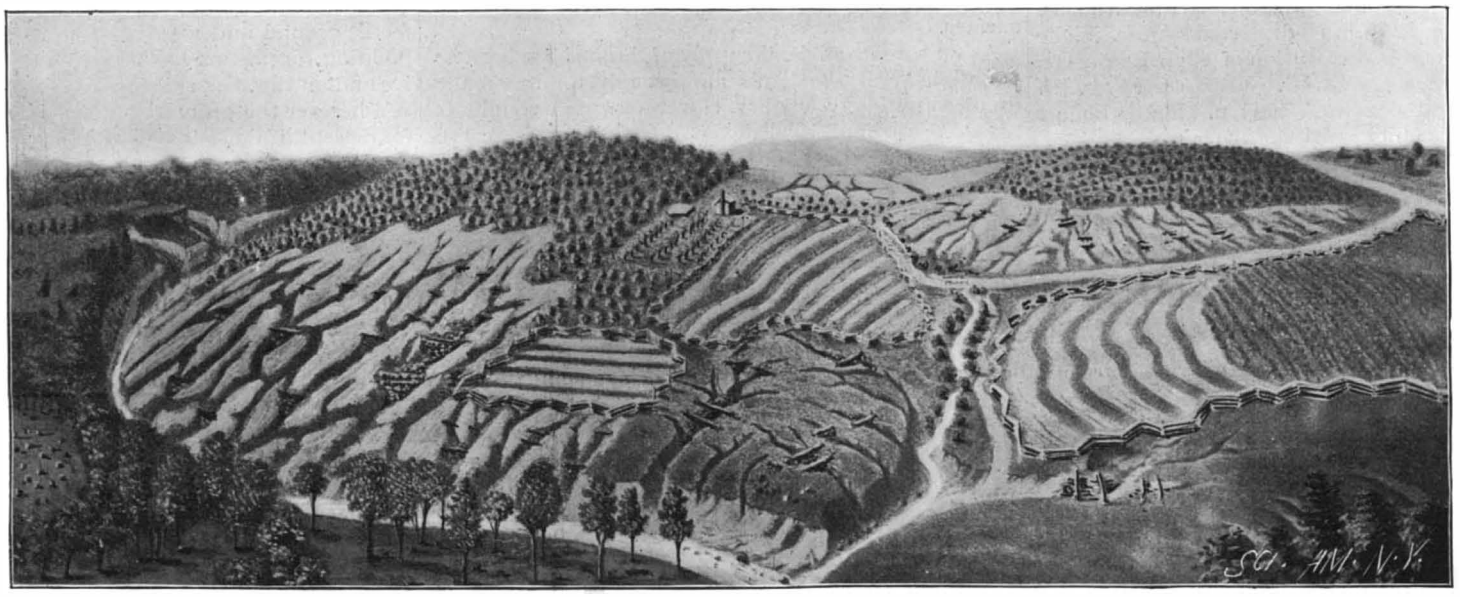

Fig. 2.—HOW THE FARM IS REGAINED.

Replant the forest and woodlands; check rush of water by brush dams; control drainage by terracing, contour plowing, and ditching; restore organic matter by manuring and cultivation.

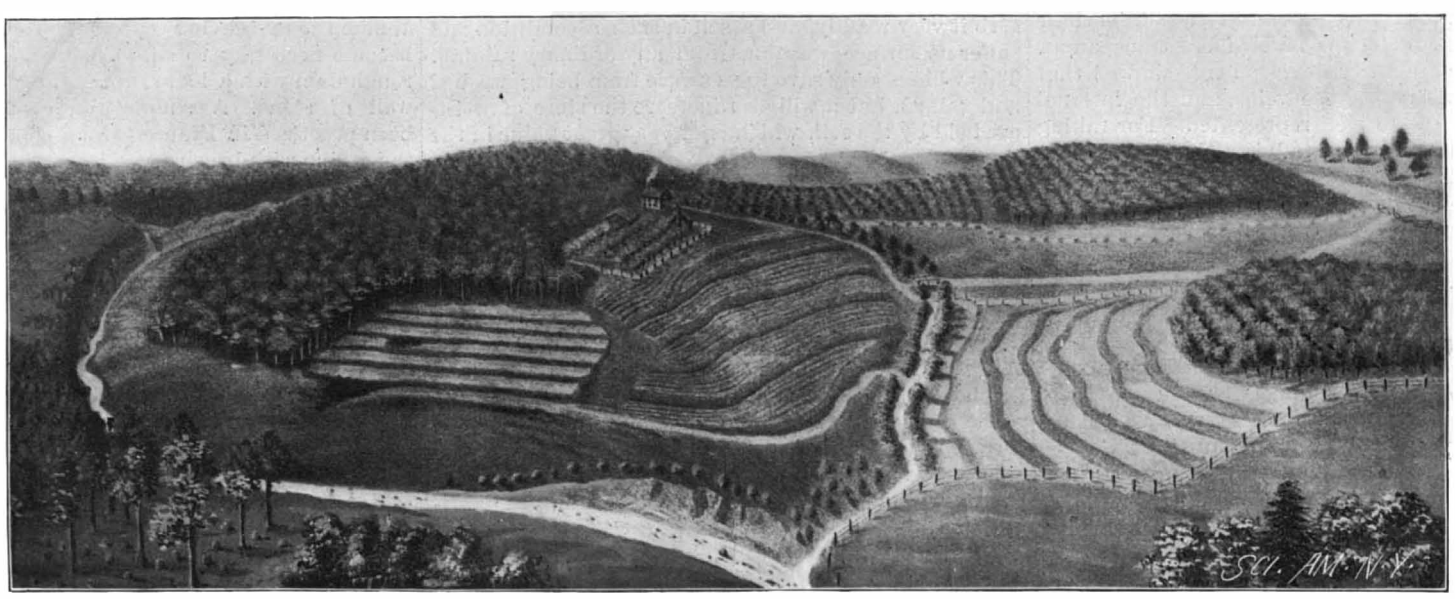

Fig. 3.—HOW THE FARM IS RETAINED.

Cut out the timber judiciously; preserve fringe of wood on banks of streams; divide farm into pasture and woodland; repair at once any damage by water.

IV.—GRASSES AND SIMILAR VEGETATION PREVENT EROSION AND WASHING OF AGRICULTURAL LANDS.

On gentle slopes a good turf of perennial pasture grasses, especially those with creeping rootstocks, prevents corrosion, or washing of lands, and short, steep embankments may also be protected with this same covering. On longer and steeper slopes, however, this method is not so effective as that of reforestation.

In enumerating the effects to be obtained by the growth of grasses and other herbaceous vegetation on washing lands, or lands liable to be eroded, it should be stated that such growths are calculated to break the force of the rainfall and prevent its packing the soil; to render the ground more porous through the root penetration into the subsoil; to make the soil more absorbent and more retentive of moisture through the addition of humus to the soil from the decay of the plants; to retard the rate with which the surface waters flow off; and lastly, to bind the particles of soil together, which is especially effective in the case of light, sandy lands and of newly formed embankments, whether of sand or clay.

THE odor of sweet peas, according to a contributor to the Medical Record, is so offensive to flies that it will drive them out of the sick room, though it is not usually in the slightest degree disagreeable to the patient.

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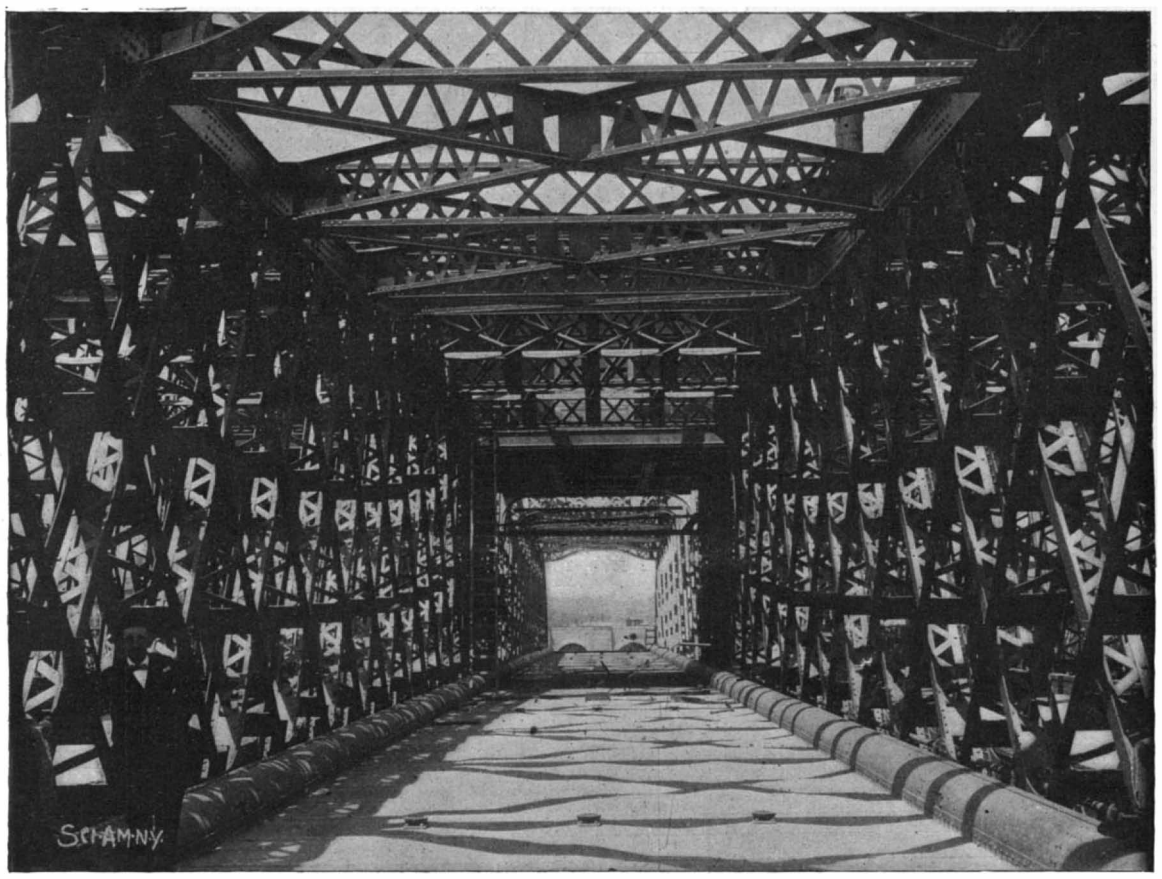
THIRD AVENUE DRAWBRIDGE ACROSS THE HARLEM RIVER, NEW YORK CITY.

The massive drawbridge which forms the subject of the accompanying engraving is the sixth structure of the kind that has been built in recent years across the Harlem River. Of these, the largest and most notable, which is owned by the New York Central and Hudson River Railroad Company, is 400 feet long and has the distinction of being the only large four-track drawbridge in existence. The Third Avenue drawbridge is 100 feet shorter; but its breadth is 86 feet, as against about 60 feet for the railroad bridge, and its total weight is about the same, namely, 2,500 tons.



VIEW LOOKING THROUGH ONE OF THE ROADWAYS.

Apart from its unusual proportions, the new structure is remarkable as showing the increasing tendency among American bridge engineers to adopt the riveted system of bridge construction in preference to the pin-connected for certain classes of work. The plate girder river spans at each end of the draw are also in line with the latest practice, which uses pin-connected construction only for the longer fixed spans of 250 feet and upward and riveted truss or plate girder work for shorter spans.

The drawspan consists of four lattice trusses which are spaced 21 feet center to center, and thus afford three separate ways, of which the outer two are roadways for vehicular traffic, and the center one carries a double track electric railway. Two footwalks, 9 feet wide, are carried on the outside of each of the trusses on cantilever brackets. The total width of the bridge over the outside railings of the sidewalks is 86 feet.

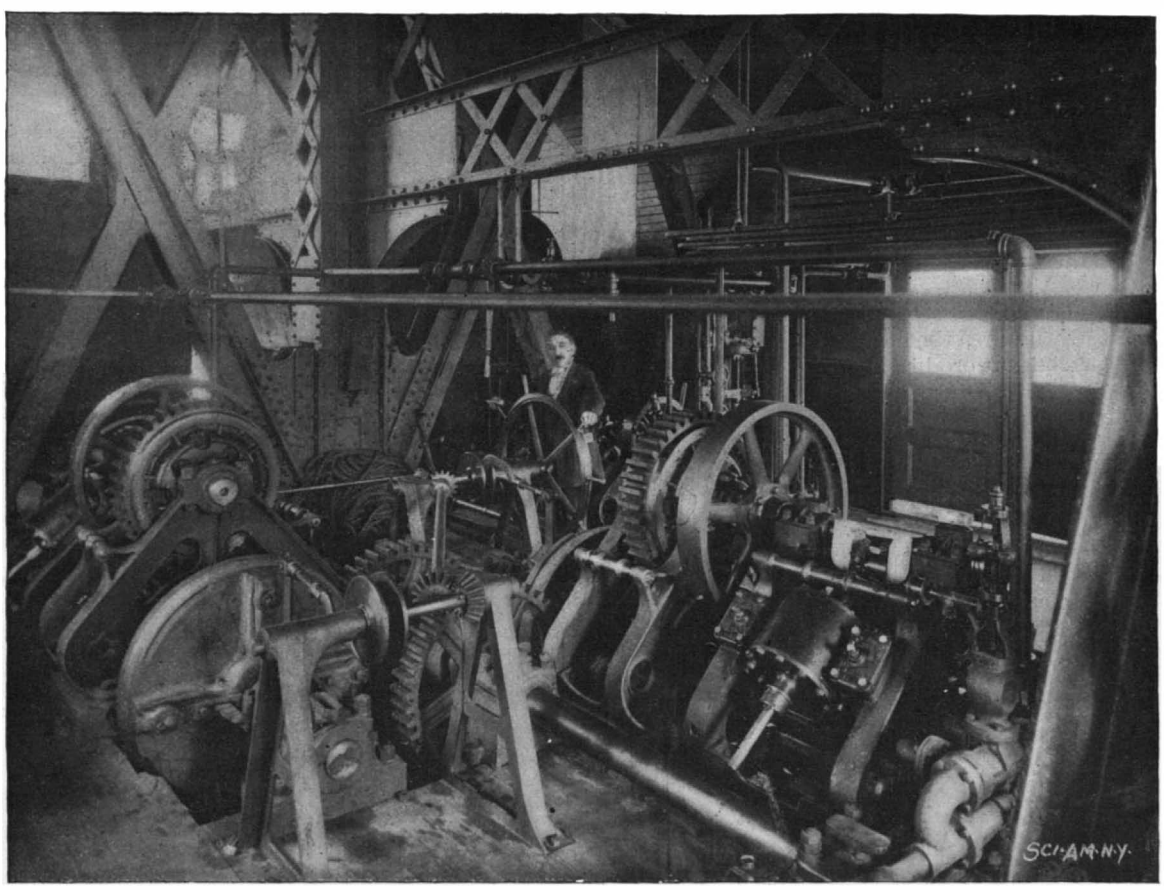
The top and bottom chords of all the trusses are of box section, the side plates being 20 inches deep and from ½ inch to 1 inch in thickness. The top chords are latticed, except on the curved ends and center, where they are closed by cover plates; the bottom chords have cover plates on the top and are latticed on the bottom. The wind bracing of the top chord system consists of small lattice girders 20 inches deep, and the bridge is further stiffened by lattice bracing between the web members.

The trusses are 38 feet deep at the center and 20 feet deep at the ends, and the engineer has introduced a novel and very pleasing feature by giving a curved outline to the top chord. It is possible, however, that the straight lines and angles which characterize the top chord of the familiar style of truss, such, for instance, as are seen in the distant bridge in the engraving, will be more satisfactory to some critics, who will urge that curved members are not theoretically adapted to meet the strains to which a truss bridge is subjected. The web members of the trusses are built up of 3½ by 6 inch and 3½ by 7 inch angle irons, whose thickness varies from ⅜ inch to ½ inch.

The floor of the bridge is carried upon 15 inch plate girders, which are spaced 4 feet 2 inches apart and are riveted directly to the bottom chords. Above the floor beams is laid a complete steel buckle-plate or trough floor, which is covered with concrete and asphalted.

The pivot pier rests upon an octagonal caisson built of yellow pine timbers, which was sunk by the pneumatic process to a solid foundation 50 feet below mean high water. The caisson is 78 feet in diameter and hollow, the center chamber being 30 feet in diameter. After it had been sunk to the required depth, it was filled with concrete to its full height. The masonry pier above the caisson is annular in shape, and tapers from 74 feet diameter at the base, where the wall is 19 feet thick, to 68 feet at the top, where the thickness of the wall is 11 feet. The wall is built with a concrete hearting and is faced with rock-faced ashlar masonry.

The total weight of the drawbridge is 2,500 tons, and it is carried by a massive plate steel drum, 60 feet in diameter, which turns upon a ring of eighty cast steel rollers, with 12 inches face and 24 inches diameter. The engines for turning the bridge are located in an engine house which is placed between the trusses and above the roadway at the center of the span. They consist of two 10 inch by 7 inch double cylinder inclined center crank oscillating engines, each separately coupled direct to a differential gear machine having a proportion of nineteen to one. The gear machines are fitted with fine hammered steel fulcrum pins, bronze rollers and bronze bushings, and operate directly by one set of spur gears, through a suitable size friction clutch on the horizontal turning shaft, which, at a speed of from zero to an average of eight to nine revolutions per minute, has sufficient grip to transmit the power of the engine. The outer ends of the horizontal shafting connect with the vertical turning shafting through powerful bevel gears. The two engines, with their differential gear machines, friction clutches and mechanism, are in duplicate design throughout, and are arranged so that each engine can run its own side independent of that of the other; both, however, being controlled in their movements of starting and stopping by one reverse valve and starting mechanism. The engines are arranged so that they can be readily coupled together, and when the whole duty of turning is to be done by one engine it is done through a set of compound gears which give the vertical shaft about one-half the speed given by the two engines. Under the same roof are housed two sixty horse power return tube boilers, which carry a working pressure of 100 pounds to the square inch. They are incased in asbestos, with an outer covering of Russia iron. In addition to furnishing steam for the main engines, these boilers run an engine and dynamo for the electric lighting of the bridge.



ENGINE ROOM OF DRAWSPAN.

Hydraulic rams are provided at each end of the span for raising the ends when the bridge is closed, and there are the customary devices for locking the draw and lifting the aprons and rail connections. All these operations are controlled by one man in the engine room, and may be simultaneously carried out in twelve seconds. It takes about two minutes to close the traffic gates, release the ends and swing the bridge to the full open position. Considering the great weight of the draw, this is remarkably rapid operation, and it is rendered necessary by the fact that between 5,000 and 6,000 vehicles will cross the bridge in the day and that the draw will have to be opened over sixty times daily for the passage of vessels. The machinery will act as follows: On the signal being given from the bridge, the gatemen will shut the gates of approach, and after travel is off the bridge, the others. Meantime the engineer withdraws the locking bolt and raises the supports and the hydraulic rams. The machinery at the same time raises the aprons which cover the gap left for expansion and contraction, and the electric car rails. When all is clear the draw is opened. Its speed is about three feet per second.

The river piers are built of granite masonry and vary in thickness from ten feet to six feet nine inches. At each end of the drawspan is a fixed plate girder deckspan 115 feet in length. It is made up of nine girders which are nine feet deep, and are spaced ten feet six inches, center to center. The top flanges carry a steel flooring of trough section, the troughs running transversely to the girders. This is filled with concrete and covered with sand, and above this is laid granite blocks on the roadways and stone flagging on the sidewalks.

The bridge was designed by Mr. Thomas Curtis Clarke, past President of the American Society of Civil Engineers, and was built by the Phœnix Bridge Company. The estimated cost of the finished structure is about $1,500,000, of which over half is absorbed by the cost of the approaches. The latter have been rendered necessary by the raising of the height of the bridge from six or seven feet to its present level of twenty-four feet above high water.

We are informed by Mr. Clarke that the present temporary bridge at the Third Avenue crossing of the Harlem River averages a traffic of five thousand vehicles daily. This is interrupted by the opening of the

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draw above sixty times in twenty-four hours, and at each opening, of course, the traffic is blocked. The traffic is not as great as this on any of the Chicago moving bridges, and the vehicles crossing Brooklyn Bridge do not exceed 4,000 daily.

Excepting the Tower Bridge, of London, which averages 6,000 vehicles in twenty-four hours, interrupted by twenty openings, aggregating two and one-half hours' delay, no drawbridge has as great a traffic as the present temporary structure.

A Scientific View of Ghosts.

BY W. E. ORD, IN THE HUMANITARIAN.

The question whether spiritual beings ever become manifest to mankind must always be regarded as one of the deepest interest. Few people, perhaps, will readily admit an honest belief in ghosts, but there is, naturally, a disposition to consider eagerly all evidence bearing on their manifestation, and indeed it is probable that under the influence of the midnight hour, with the surroundings supposed to be favorable, all persons find little difficulty in appreciating the possibility of supernatural occurrences. We therefore find an ever recurring period of discussion of the subject, while an earnest endeavor is now being made to sift the large mass of evidence which is continually forthcoming, in order that any foundation of truth which exists may be discovered.

Secondhand evidence, however—usually the only evidence obtainable—has been brought into deserved contempt in this connection, and notwithstanding the most diligent and patient inquiry, it can scarcely be said to have settled any part of the question to the satisfaction of those whose opinion would be authoritative. To the love of a good story, savoring of the marvelous, to fear and illusion, to self-deception, exaggeration, and untruth, may be ascribed nine-tenths of the numerous accounts of supernatural occurrences which continually find a ready acceptance, while the failure to obtain trustworthy evidence by those who undertake an honest and scientific investigation would almost cause us to despair of human testimony altogether when it approaches this subject.

There is, however, another method of testing the validity of the belief in supernatural manifestations which it is surprising is not more often resorted to. We live in an age which has seen and is now seeing a progress in science unparalleled in human history. Every branch of knowledge has been opened and has had new light thrown upon it, and, as the result, we find that many of our older beliefs have had to give way altogether to newer and more rational views, while others have been greatly developed on a surer foundation. The belief in ghosts, originating in times of superstition, and involving certain assumptions with regard to nature and the human senses, can also be examined in the light of our later knowledge, and it may have to stand or fall by the result.

Instead, therefore, of considering the character of witnesses, the confirmation of circumstantial evidence, and the like, let us examine what the statement that a ghost has been seen or manifested can really mean in view of the scientific knowledge of the present day. Let us rather analyze the process of such a manifestation, and the ghostly nature, than question the veracity of the percipient or his sanity.

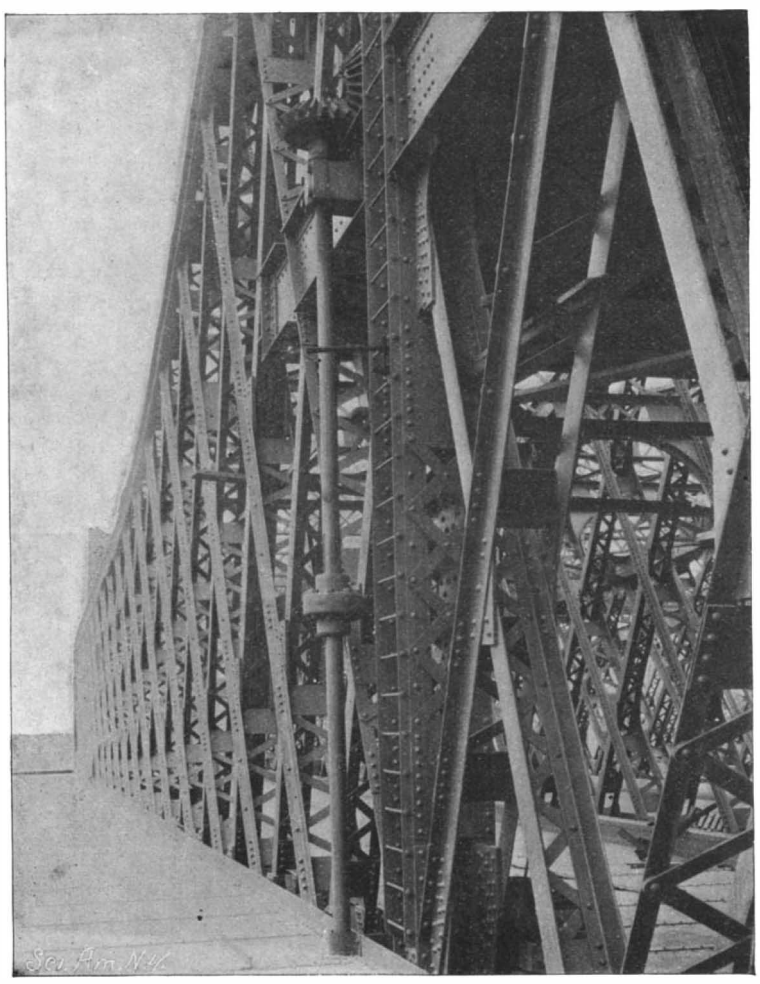
Modern science will first prove to us that ghosts—other than phantoms and hallucinations of the mind—can only become manifest to human beings by appearing in some material form. It is certain that nothing can be actually seen or heard except through the medium of the senses, and it would seem to be established that the senses can only respond to outside, or objective, influences in the form of energy acting through matter. Ghosts or spirits, therefore, if they appear to human beings, must for this purpose assume some material form. In order to be seen they must, when analyzed, exist in that form of matter and energy which acts upon the retina of the eye, and in order to be heard they must produce those vibrations of matter which cause the phenomena of sound.

On the other hand, the experiences of those who have seen ghosts would indicate that their material form is by no means substantial. They appear within closed doors without sound or warning, and vanish like the morning mists. Sometimes they affect one of the senses only; at others they are seen, heard, and felt, like ordinary human beings. Yet, in whatever way they are manifested, they must still appear in some material form, and it might be concluded that spiritual beings are able at certain times to give life, as it were, to some form of matter. When the ghost or spirit has accomplished its manifestation, it departs to its spiritual home, and the matter which it had touched into life and energy remains as before, unnoticeable by the ordinary human senses.

Another explanation of such appearances may, however, be suggested. The spiritual manifestation may not depend upon the will of the spirit, upon its power to materialize itself, but rather upon the state of the percipient's mind, and the abnormal development of his senses at the particular time. Spirit and matter are usually opposite terms, but we may nevertheless conceive the so-called spiritual world as in reality a material one analogous to our own. Recent science has shown that there is probably a world of energy and matter hidden from our ordinary senses, of which we can only conjecture from the suggestions obtained when the photographic plate records more than the human eye is ever capable of seeing, or the magnetic needle responds to an influence quite unfelt by our dull senses. Now it may be that it is in such a hidden world that ghosts have their existence—spirits finding a dwelling place in forms as much material as those of ordinary human beings, but of an essentially different, and perhaps more ethereal, character. Into their hidden world of peculiar and unknown energy mankind cannot usually enter, but at critical times in a man's life, corresponding to the fitful and occasional appearances of ghosts, his senses may be abnormally developed, so that—as with the photographic camera—he sees more than his eye is ordinarily capable of seing, and may become conscious by sight, or hearing, or touch, of that hidden world in which ghosts live, and move, and have their being. This view would explain much that, on any other ground, is antagonistic to belief in ghosts of any kind. Such difficulties as the perception of the apparition by only one person, or the appearance when the percipient is in an unusual state of mind or health, would be removed, and it must be admitted that the uncertain and fitful character of the visitations, and the failure to occur under any test conditions, would be quite in keeping with such an hypothesis. It must not be forgotten, however, that an abnormal state of mind might be the cause of the apparent manifestations.

In the much talked of appearances known as death wraiths there would also appear to be an abnormal development of some of the faculties. The apparition of a person who is dying in a distant land is seen by a very sympathetic friend, who is thereby impressed with a sense of his friend's danger or loss. In such cases there must be an influence which sets distance at defiance, and which acts in a manner for which the phenomena of electricity afford the only analogy. Between minds in deepest mutual sympathy there is much that would suggest an influence different from that which the ordinary senses are capable of conveying, but in the appearances of death wraiths the influence by material agency becomes incredible. It may easily be imagined that the electrical and other changes which are continually taking place in the brain, acting upon the surrounding medium, have an influence upon the minds of those with whom we are intimately associated, and ideas—which all have their physical counterpart in the brain—may, as in thought transference, be transmitted to those minds attuned, as it were, to receive them. Similarly, perhaps, in the case of death wraiths, the dying person, thinking of the friend, and yearning intensely to communicate some last message, may be supposed to exert his influence in a degree for which ordinary circumstances find no occasion, and may be able, at such a time, to produce in the mind of the friend at a distance a vivid sense of his presence. It is certain, however, that if this is so, science must make great progress before it can be understood how such communication takes place.

These explanations of ghostly phenomena are offered merely as suggestions, which might bring the occurrences into conformity with the ascertained laws of science. It is perhaps doubtful whether the ghostly visitors, who are usually shy with those desirous of becoming well acquainted with them, will not vanish altogether under the critical eye of science, and the belief in them, born perhaps of the unreasoning state of mind, may not bear any wholesome theory of their existence. There is, however, too strong and sincere a conviction in favor of such a belief for it to be dismissed offhand. In view of the weighty and prevalent opinion which can be cited in favor of the supernatural manifestations, serious inquiry is greatly to be desired, and some theory of the actual occurrences becomes essential. An endeavor to explain the phenomena scientifically may help to decide the validity of the belief in their existence, or else prevent that unhealthy state of mind which is too often its sole origin.



ONE OF THE OUTSIDE FOOTWALKS.

Venomous Fishes.

In many seas, especially those of the tropics, are found fish provided with a poison apparatus, which consists usually of a spine or spines more or less erectile in character, and connected with a poison gland. Prof. James D. Brunton gives an interesting account of two of these fishes, the Trachinis draco and Scorpæna scropha says Appleton's Popular Science Monthly. They are only poisonous as a serpent is poisonous—i. e., by wounding; their flesh is good and wholesome. Although the fish differ widely in appearance, yet the poison produces the same effect. The Trachinis draco is a handsome fish, not unlike a trout in general appearance. Upon each of its gill covers is situated the spine, connected with its poison gland through a duct formed by the combination of a groove in the spine and a very thin membrane, which covers the latter almost to its point. When the spine enters a resisting body, the membrane is pushed back, allowing the poisonous secretion free access to the wound. The gland is small, with nucleated colorless cells secreting a transparent fluid. The Scorpæna, on the other hand, is an unattractive looking fish, squat of body and having a large misshapen head. It may attain a large size, and is called by the French fishermen "le diable." The special organ in this fish is connected with the first three rays of the dorsal fin, the duct being formed as in Trachinis. There is also a spine on each gill cover connected with a poison gland. The effect of a wound from either of these fishes is quite a serious matter. At the moment of puncture only the sharp prick is felt. In a few minutes, however, the parts commence to burn and itch, and then become acutely painful. These pains increase in violence and extent. Then a feeling of suffocation is felt, and pain over the heart. From this time commence those cries of anguish which can always be recognized as caused by the acutest torture and fear. The cries are continuous, and beads of sweat stand on the brow. Flashes of light pass before the eyes, and the pulse is found to beat intermittently. Finally, delirium and convulsions supervene, which may pass on to collapse and death, or may, after lasting for many hours, gradually subside, leaving a malaise which is very difficult to get rid of. The point of puncture soon shows the results of intense irritation, and may eventually become gangrenous and necessitate amputation. The treatment is practically the same as that for a snake bite. The poison approaches that of the serpent in character, being alkaloidal, very quickly decomposed, and intensely rapid in action. It is secreted in large quantities at the spawning season, and is most active in the male fish. On coasts where these fish abound it frequently happens that bathers are poisoned by stepping on one of them, the Trachinii being especially fond of concealing themselves just under the sand in shallow water. It would be of interest to know whether Dr. Calmette's snake bite antitoxin is also efficient against the venom of these fishes.

AN electric omnibus, which goes four miles in half an hour, is now running in the London streets.

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A Visit to the Buried Churches in Cornwall.*

A ramble of about two miles over the sandhills from Perranporth brings us to the site of the far-famed buried churches of Cornwall. They are not at all easy to find, and the first time I went alone in search of them, I lost my way completely. So the second time, resolved not to be beaten, we secured the help of the gallant "Capt. Tom," one of the oldest inhabitants of the district, formerly the manager of a mining company, a great traveler, and a very well informed, excellent man. Under his guidance and in his most enjoyable company, we were without much difficulty personally conducted to the veritable ruins. A rather toilsome climb was soon rewarded by a glorious view of the Atlantic and of the country spreading far and wide, and ere long we came upon the object of our search—a little stone building, so sunk in the sand as to easily escape notice. It is simplicity itself; and yet to all English Christians, especially to churchmen, it is fraught with the deepest interest, as being all that remains of a real British church built either in the fifth century, by Piranus, or in the sixth, over his grave, in memory of one of the earliest preachers of the Gospel in Cornwall. He is said to have been one of twelve bishops consecrated by St. Patrick and sent over by him, if not in company with the Apostle of Ireland, to evangelize the ignorant natives of that part of England. He was of noble birth, being descended from the Princes of Ossory. His father was Lugneus and his mother was called Liadem. His Irish name was Kieran or Claran; for in this instance, as in many cases, the Irish "K" became "C" in Cornish. After many years of successful labor in Ireland and Cornwall, he is said to have been beheaded as a witness for the faith he had preached. He is supposed to have fixed his humble dwelling in this retired spot by the sea, yet within sight of the amphitheater which would be the general resort of the scattered inhabitants. We know little more about his life or work; but we are told on good authority that, "worn out with old age and infirmity, he called his children in the spirit around him, and having exhorted them for the last time, he commanded his grave to be prepared, and, he having descended into it with calmness, his spirit departed."

Most probably this oratory was erected over his remains. In the course of time the sand, swept along by the northwest wind from the ocean, gradually covered it out of sight.

Taking advantage of a stream which then rolled down the neighboring valley to the sea, and served as a barrier to the advance of the sand, the Christians of the place built another small church about half a mile from the site of the first, which lasted for some centuries, until the rivulet was diverted by the opening of a mine, and the sand began to accumulate again, so that this second church had to be rebuilt on a larger scale in 1420. The same fate threatened it in turn, and in 1803 the building was taken down, and its tower, porch, pillars, arches, font and other principal parts of it, were removed to the present site, about two miles off, in the center of the parish, still known as the church of Perranzabuloe, a singular name derived from sabulum, the Latin word for sand, and signifying "Perran in the sand." An ancient obelisk, surmounted by a Greek cross, still marks the site of the second buried church.

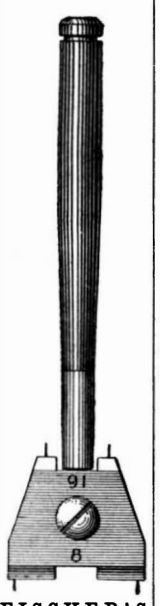
This most remarkable ruin of the first church was brought to light by Mr. Mitchell in 1835. The sand was carefully excavated, and then appeared the remains of the original building, much as they are now. These consist simply of an oblong framework of thick walls, of rough, unhewn stones, granite, porphyry, and slate, piled one upon another without mortar or cement; only sand and the china clay of the neighborhood being interspersed between the stones. When the ruin was first exposed to view, there was a low doorway with a stone moulding round it, which, contrary to either Norman or Saxon usage, was carried from the head of the arch down the sides, and the supports of the arch were perfectly plain, without capital or bases. This doorway fell to pieces within a fortnight after it had been excavated. Its principal fragments were laid up in the Truro Museum, while the rest was carried away by too curious visitors. There was also a window of the rudest form ever seen, measing just 18 inches by 12. The floor was of china clay and sand, and was distinctly divided into nave and chancel. Stone seats were there, attached to the east wall, and there is still a stone slab, probably the original communion table, under which were discovered three skeletons, one without a head, which may have been that of St. Piran, and one of the others, that of a woman, most likely his mother, who is said to have been buried with him. A head, corresponding to the headless skeleton, was afterward found on the south side of the church. All this singularly agrees with what had been long before recorded by Camden, and has been drawn by him from very ancient sources. It is interesting to add that there are indications close by of a very old burial ground, where thousands of human bones have been brought to view, many of which, now in a very comminuted state, still lie bleaching on the hillside, as in the valley of dry bones that Ezekiel saw in vision.

* Extract from "A Ramble in Cornwall," by the Rev. William Burnet, M.A., in the Fireside for March.

NEW CIRCLE DIVIDER.

Most draughtsmen have found by experience that dividing a circle into a large number of divisions is a tedious and often disappointing task, because the smallest error in setting the dividers to the distance calculated is multiplied on the circumference by the number of divisions.

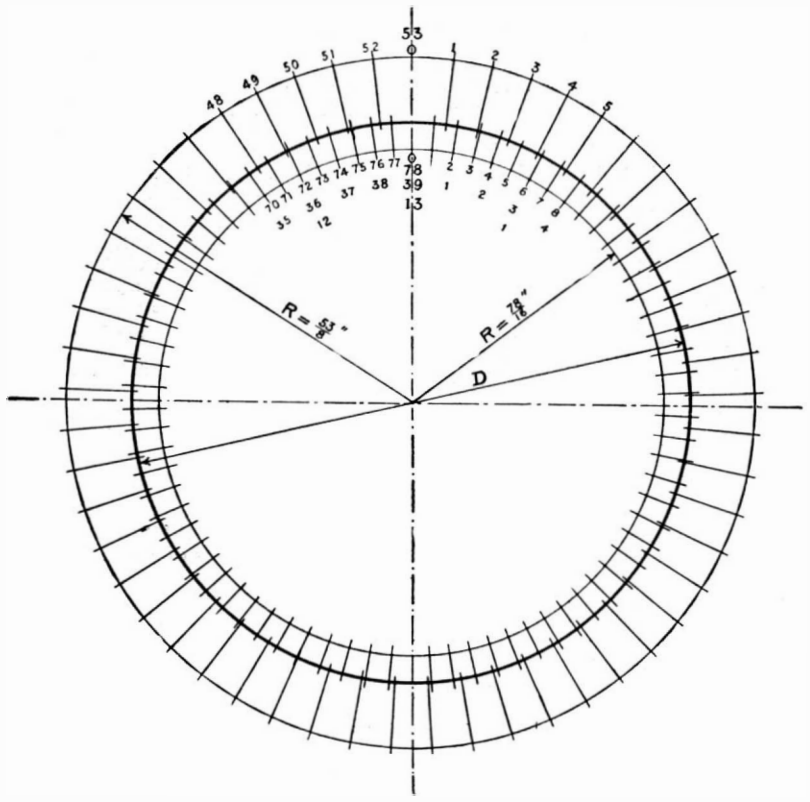
Several instruments have been devised for the purpose of dividing the circle, but they are either too high in price or too unhandy, and draughtsmen have generally preferred to calculate, use tables, or guess and take their chances.



FISCHER'S CIRCLE DIVIDER.

The simple instrument here illustrated dispenses with calculating tables and guesswork and is, at the same time, a handy and practically correct device. It consists of two pairs of fixed needle points, marked 8 and 16 respectively, which are reversible on a little handle. The points are so spaced that any circle of the proper radius will be correctly divided into the desired number of parts. It is only necessary to draw an auxiliary circle concentric with the circle to be divided and of a radius of so many eighths or sixteenths of an inch as there are parts desired. The pair of points marked "8" or "16" will divide this auxiliary circle into the desired number of divisions, which are then projected on the circle to be divided.

For instance, a circle is to be divided into 74 parts: draw a concentric circle of $\frac{74}{16}$ inches (equal $4\frac{10}{16}$ inches). On this circle the pair of points of the instrument marked "16" will make 74 equal divisions; or the points marked "8" would divide the same circle into 37 parts, because $\frac{74}{16}$ inches are equal to $\frac{37}{8}$ inches (equal $4\frac{5}{8}$ inches). This little instrument is very useful in designing gears, cams, chain wheels, conveyors, water wheels, etc. It is manufactured by Keuffel & Esser Company, No. 44 Ann Street, New York.



METHOD OF DIVIDING A CIRCLE.

Successful Kite Signaling.

On Monday, July 5, some very successful experiments in night signaling by means of colored lights sent aloft on kite strings were conducted by Lieut. Wise, U. S. A., and Mr. William A. Eddy, of Bayonne, N. J. Lieut. Wise was on Governor's Island, and Mr. Eddy was at the New Jersey Oval, in Bergen Point. Mr. Eddy was unable to lift his signal to the high altitude he desired, but he succeeded in raising the lights to a height of at least 500 feet. The signals were perceived by Lieut. Wise on Governor's Island, eight miles away. Mr. Eddy burned red and green lights at stated intervals, and so alternated them that they formed a code of signals. Lieut. Wise had no difficulty in locating and reading these signals. He replied with his own signals, which were not discovered by Mr. Eddy's assistants in time to permit the reading of the complete signal. The experiments were continued until almost midnight.

Ship Canal from the Baltic to the Black Sea.

Now that the Transsiberian Railway is far advanced toward completion, the Russian government is planning another great scheme which will outrival in political importance the Kiel Canal, says the New York Sun. It has always been considered by the Russian strategists as a source of great weakness that the naval forces of the empire should remain divided in such a way that one-half only, either the Baltic or the Black Sea fleet, could be available at one time. Between the north and the south there is no way for a naval concentration, communications being blockaded in the north by climatic and in the south by political obstructions.

There is a motto in maritime affairs that nothing can be improvised; everything has to be foreseen. It was with a clear understanding of this truth that the late Czar, Alexander III, gave instruction to his engineers to study the possibility of a maritime canal to connect the Baltic with the Black Sea; this canal to be constructed with dimensions sufficient for the transit of the largest war vessels. After a thorough study of the various possible roads, one has been selected as the most practical, running, as it does, entirely through Russian territory. On the plan selected there are no great difficulties of level to be overcome, although the European watershed summit has to be crossed, but this last takes place at one of its lowest points.

The proposed canal's entrance will be on the Gulf of Riga, at the mouth of the river Duna. It will follow the course of this river up to a point above Dunabourg. Then, leaving this valley, it reaches the Berezina River by a straight cut and passes through Babrouisk. This brings it into the Dnieper, and, following this natural declivity, it reaches the Black Sea, opening into a magnificent roadstead below the Kerson. The total length of this colossal waterway will be something like 1,600 kilometers (about 1,000 miles), and it will be excavated to a depth of 8½ meters (about 27 feet). This will allow the largest ironclads to navigate it freely from one end to the other. The estimated cost is put down at $500,000,000.

Its strategic importance does not need demonstration. By the selection of a course running at a safe distance from the frontier, it places back of the Russian forces stationed in Poland an unassailable base of operation. Fully protected already by a whole network of fortifications and railways, this canal is intended to act as a feeder for all the war material. As to the concentration of the whole Russian fleet in the Black Sea, this means an absolute control of Constantinople and the Straits.

But if this enterprise is of the utmost importance in a military point of view, it will also prove unquestionably very beneficial to the agricultural and industrial interests of the country. It places vast grain-producing regions in cheap communication with Odessa, the chief point of export, while the immense coal fields of southern Russia will come into easier connection with the industrial districts of Poland. There are reasons, too, to believe that new factories will develop along the canal on account of the cheapness of this new mode of transport. If this scheme has been adopted, there is no doubt that the Russian tenacity will bring it to success.

The Shoreditch Refuse Destructor Plant.

On June 28, Lord Kelvin opened the works established by the municipality at Shoreditch, England, which is designed to destroy the local refuse, generate electric light, and supply hot water to the public baths and laundries. Carts will convey the street, trade and household refuse to the works, where motor cars and electric hoists will distribute it to tipping platforms. Hence it will be shot by the aid of mechanical feeders into a dozen cells of the destructor. A forced draught is provided by motor-driven fans, some of which will exhaust an adjacent sewer and blow the gases therefrom into the furnace to help feed the flame. Steam generators and boilers will be used to drive the engines and dynamos and heat the water to be furnished to the baths and laundries. It is expected that 20,000 tons of refuse a year, which has formerly been carried out to sea at great expense, will be consumed annually in this plant. Lord Kelvin, in opening the works, described the project as an extremely happy union of scientific knowledge and mechanical skill, and said that it required remarkable courage in its application in this initial plant.

THE Rockefeller steamer Robert Fulton, 440 feet over all, is the largest steamer on the Great Lakes.

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RECENTLY PATENTED INVENTIONS.

Engineering.

GAS ENGINE.—Lewis S. Brown, Columbus, Ohio. This invention relates to an improvement in four period engines, arranged to insure a proper mixture of air and gas and a positive ignition of the explosive mixture. When the engine is in operation a valve shaft is rotated so that an electrode, at every revolution of the shaft, closes and breaks a circuit, making a spark to ignite the explosive mixture in the working chamber of the cylinder. The mixing chamber is connected by a valve with a cylinder connected with the gas supply pipe, and by another valve with an air tube, both the air and gas being drawn through fine wire netting, and both the air and gas being drawn into the mixing chamber by the suction caused by the movement of the piston.

WATER TUBE BOILER.—William C. Stuckel, Chicago, Ill. To insure rapid circulation of the water and quick generation of steam this inventor has devised a boiler in which a series of inner upflow water tubes connect an upper and a lower water compartment, downflow water tubes surrounding the inner tubes, and a fire box in the lower compartment having its crown sheet extending below the inward upflow water tubes to cause the heated water to rise directly to the upflow tubes, the cold water flowing downward from the outer downflow tubes to the crown sheet. The downflow water tubes have a larger area than the aggregate area of all the upflow tubes, so that an unobstructed circulation of the water is had at all times.

Bicycles, Etc.

BICYCLE PARCEL CARRIER.—Henry W. Heaton, Olneyville, R. I. This is a device arranged for convenient folding, to occupy but little space when not in use. It consists of a metallic frame, with netting to form a basket, and a clamp secured to the bicycle frame on which the carrier frame is pivoted. The latter frame is made in sections, and the clip members have that portion next the clamping screw made straight and divergent to engage larger or smaller parts of the bicycle frame. The netting is preferably made of strands of knotted cord, so that when the frame is swung up and not in use the netting hangs down loosely in the frame without occupying much space.

BICYCLE LOCK.—James J. Byrne, Detroit, Mich. This inventor has provided a permutation lock applicable to the steering heads of bicycles, to engage and hold the steering fork, so that it will be impossible to use the machine. The lock has an exterior casing mounted to turn and adjust the position of the tumblers, the casing having a flange with a broken periphery capable of being engaged by an object to determine the number of notches turned by the casing. When it is light the rider may see the notches turned and operate the lock without the key plate, but the lock may be operated in the dark by counting the pulsations of the key plate against the hand.

Electrical.

CIRCUIT BREAKER FOR ELECTRIC WIRES.—Andrew J. Clark, Lexington, Ky. For automatically breaking the circuit of a trolley or other electric wire, should the wire break and its ends fall down, this inventor has patented a device which is efficient for this purpose and also serves as a hanger for the wire. It comprises vertical levers having contact plates extended at right angles from the lower ends, and to which the current carrying wires are attached, a block of insulating material to which the upper ends of the levers are pivoted, and lugs on the lower portions of the levers adapted to interlock when the levers are in their closed positions. The lugs cause the contact plates to engage closely, but the engagement is not strong enough to hold the plates together when the strain of the wire is released.

TIME ALARM.—Alvah C. Roebuck, Chicago, Ill. A graduated disk rotated by clockwork, according to this invention, is made to move in conjunction with the minute hand to close a circuit containing an alarm or signal. The disk has adjustable arms adapted to be set to the time when the alarm is to be sounded, such arms actuating a lever to move a contact point in the path of a contact point on the minute hand of the clock, whereby the device may be readily set for any hour and minute and the fraction of a minute. The length of the contact may be adjusted to suit requirements by making the size of the contact points accordingly.

Mechanical.

RIVETING MACHINE ATTACHMENT.—Alfred E. Watts, Duluth, Minn. An attachment is provided by this invention by which the riveting machine can be used both for riveting parts together and for again loosening the rivets to withdraw them from the fastened parts, the rivets being reformed to permit them to be used again. The invention consists principally of a die interposed between the rivet holder and the punch of the machine, the die being formed with an opening in alignment with the rivet holder and terminating at its lower end in a widened mouth.

RULING MACHINE.—Frank Hudson, Covington, Ky. This machine is adapted to take a roll of paper from a paper-making machine and rule it on one or both sides in any colored ink or combination of inks, cutting the ruled paper to proper lengths and widths, and counting and assembling the ruled sheets, the operation being performed continuously. All parts of the machine are so geared that the impression rollers and dies move at a uniform speed with the paper, and the machine is simple and inexpensive to build and operate, requiring only one hand to superintend its operation.

COFFEE HUSKING.—Thomas F. Doyer, Pasoeroean, Java. According to this invention, the berries are subjected, before hulling, to a treatment to loosen the hulls from the grain, the berries being fed into a compressing or loosening apparatus, and gradually conveyed toward the outlet by a screw, whence they are taken by a stream of water into the hulling machine proper, where primary hulling rollers tear the hulls open and screw-threaded finishing rollers hull the berries and simultaneously convey them longitudinally of the rollers. The process and machine are designed to effect the complete removal of the red hulls and the avoidance of all sieves and sorting or grading devices, the work at the same time being so performed that the berries are exposed to view during the whole operation.

Agricultural.

STALK CUTTER.—Charles Shafer, Bedford, Neb. To facilitate cutting corn stalks in the field, this invention provides an attachment to the riding frame of a reaper or mower to force the stalks close to the ground and cut them, while in such position, in specified lengths. The attachment may be applied to any form of truck, with which are connected uprights and a shaft sliding in them carrying a knife, arranged to have a reciprocating and partly rotating movement. The knife is reciprocated to cut the stalks in required lengths as the latter are forced and held flat to the ground by a roller, the operating mechanism being simple and positive.

Miscellaneous.

UNDERFLOW TESTING APPARATUS.—Howard V. Hinckley, Topeka, Kansas. For accurately measuring the extent and permanency of water supply to be had in any special location, this inventor has devised an apparatus which is available when the width and depth of the water bearing stratum and the rate of slope are known. It comprises a trough or flume whose inner sides are coated with pitch, there being a screen near each end and a series of stoppered outlets at different heights at one end. The pitched sides and bottom of the trough between the screens are coated and the trough filled with the gravel of the locality to be tested, the trough partly filled with water and given the desired inclination, when the speed of flow is determined by the efflux from the outlets, a series of trials being made for each locality.

LIFE SAVING RAFT.—Edward Clark, New York City. This is a form of raft in which parallel elongated floats or buoyant chambers are connected together by an intermediate framework, the whole being designed to support a great number of people. It is made partly of a flat-bottomed boat, to whose bottom are attached cross bars connecting with the floats at the sides, the latter being also connected by straps or braces with the upper rail of the boat.

SNAP BLOCK.—Thomas Dods, Guttenburg, N. J. This device comprises a frame having a pivot and a screw rod, a cross piece hung on the pivot having at its free end a recess to engage the screw rod, while a nut on the screw rod has an outlet fitting into a counterbore in the top of the cross piece at the inner end of the recess. The block is arranged for convenient opening and closing, to connect or disconnect a rope or cable, without requiring reeving and without danger of losing any of the parts or weakening the block.

SAFETY OIL CAN.—William Bell, Bay Side, N. Y. Two patents have been granted this inventor, according to one of which the can has an air inlet extending from the nozzle into its upper end, the inlet being connected with a vessel adapted to contain a liquid, and the vessel also having an air inlet. It is designed more especially to facilitate the filling of oil lamps, preventing their overflow by the closing of the oil inlet and giving a signal when the lamp is filled to the proper limit, and also indicating when the can is empty and the lamp not filled to the proper height. According to the other invention, the vent pipe is made in sections, one of which extends from the oil can nozzle into a closed vessel below the liquid therein and the other section connects the top of the vessel with the interior of the oil can. The closed vessel is preferably made of glass or other transparent material.

FASTENER FOR NECKTIES, ETC.—William A. Bunn, 621 Alexander Avenue, Winnipeg, Canada. According to this invention, spring arms carry a pair of pins extending in opposite directions, a ring engaging the shank of the collar button or other part on which the article is to be suspended, the ring being a continuation of the spring arms. The device may also be used as a vest pocket guard for a pen or pencil, or wherever a ring would be attached, as on curtains, suspenders, etc., or in fastening jewels on regalias.

VACCINE POINT PROTECTOR.—George G. Rambaud, New York City. To protect the lymph from contact with foreign substances that may be floating in the air and render it possible to employ liquid virus in connection with an ivory point, this inventor provides a casing, preferably of glass, into whose open end is fitted a stopper, the stopper forming the outer end of the point having on it the liquid virus. A sealing liquid is placed over the stopper when it is put in place, and, thus prepared, the virus may be kept for several months in a cool place.

AUDITORY INSTRUMENT.—John H. Kellogg, Battle Creek, Mich. To increase the volume and delicacy of sound waves, this inventor has devised an attachment for stethoscopes, or for the use of partially deaf persons, comprising a bell-shaped body with thin diaphragm across its mouth, a spring having a pin that bears on the inner side of the diaphragm, a removable spring clamp attached to the body and having a central disk that bears on the outer side of the diaphragm, a post projecting from the center of the clamp, and a disk or tip attached to the free end of the post. The clamp attachment is supplemental, and is used with the stethoscope and by partially deaf persons.

DENTAL ENGINE MALLET.—Clyde E. Williams, Springfield, Mo. On the outer end of the mallet casing, according to this invention, is a socket adapted to receive the plugging point, and a spring engages the hammer to force it in one direction, while the length of the stroke is regulated by a rotating shaft and a cam and pin placed one on the hammer and the other on the shaft, a stepped slide being interposed between the hammer and the plugger. The stroke is delivered whether the plug is touching the tooth or not, and the blow is as effective as that delivered by the usual hand mallet, but many times more rapid.

PLACKET FASTENER.—Henry C. Zenke, Brooklyn, N. Y. This device consists of two flexible bands adapted to be held in the placket facings of a skirt, one band having at its lower end a guideway to receive the lower end of the other band, and each band having at its upper end a flange to fit in the waist band, one of the flanges having a hook and the other an eye. It is impossible for the placket to open accidentally when the dress is worn.

Designs.

CLOTHES PIN.—William M. Gilbert, North Wales, Pa. This is a cylindrical pin with terminal bulb at each end and a central lateral notch or cut in the shape of a slot, to which there is a side opening, there being in one side of the slot in one of its walls a transverse groove.

TEAPOT.—Austin F. Jackson, Taunton, Mass. This is a rich design affording a novel shape and artistic ornamentation of the body, legs, handle, spout and top.

HANDLE FOR PANS OR LIDS.—William E. Baxter, Frankfort, Ky. This handle has an upturned hooklike part and a tanglike projection to fit the slot in stove lids. It is stamped out of one piece of metal, being also made long enough to be utilized as a poker.

TOY.—Oscar McDonald, Jersey City, N. J. This device is made of a wire post with ring at the top, below which is a hand hold where cord may be wound, and still lower down is a tin disk which presents a unique appearance when the top is spun.

PUZZLE BOARD.—Furman W. Velsor, Cold Spring, N. Y. This is a triangular board with intersecting lines forming the outlines of four triangular spaces and six diamond-shaped spaces.

BELT FASTENER.—Jonathan Hill, Jersey City, N. J. This fastener consists of an arched bar whose ends curve over the body in hooklike form toward each other.

DRUGGIST'S GRADUATE.—Chambers E. Kemble, Brooklyn, N. Y. This is a graduate glass having a base in the form of threaded spiral, an annular flange capping the spiral.

SAMPLE CARD.—Arthur W. Clapp, New York City. This card is divided to present a series of panels, in each of which is a semblance of a spool of silk or roll of woven fabric, there being in each of the panels a representation of a spool or reel.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

A PRETTY BANDIT. By Frank Bailey Millard. New York: The Eskdale Press, 1 Madison Avenue. Pp. 264. Price $1.

SKETCHES OF TRAVEL IN NORMANDY AND MAINE. By Edward A. Freeman. With illustrations from drawings by the author and a preface by W. H. Hutton, B.D. London: Macmillan & Company Limited. New York: The Macmillan Company. 1897. Pp. xv, 243. Price $2.50.

This really beautiful book may be said, without too much flattery, to possess a double charm. The make-up of it is very elegant. The text is excellent and the author's pen and ink drawings which are reproduced are, in this day of half tone work, a positive relief. We can imagine that the work, to one who travels in France and employs his time in the largest sense, would be a most acceptable guide book, something to be read as the different spots mentioned were reached. Some of the author's drawings are almost in forced perspective, but by taking the proper point of view, this somewhat wide angle effect noticeable may, to an extent, be avoided. The author is a thorough architect and his illustrations relate to the architecture of the region exclusively.

FUEL AND REFRACTORY MATERIALS. By A. Humboldt Sexton. London: Blackie & Son, Limited, 50 Old Bailey. Glasgow and Dublin. 1897. Pp. 352. Price $2.

An up-to-date work on fuel is most acceptable; one which covers the different fuels, their preparation, all kinds of producing furnaces for producing gaseous fuel, the recovery of by-products, advanced metallurgical furnaces, and which, last but not least, treats of pyrometry, calorimetry, the utilization of fuel and its practical analysis. The final portion of the book is devoted to refractory materials, and among them we find silica bricks and basic bricks, with other advanced types of furnace linings given. It will be evident that we have here a very interesting contribution to metallurgy, and the few topics we have cited go to show how advanced a field it occupies.

LIFE AND IMMORTALITY; OR, SOUL IN PLANTS AND ANIMALS. By Thomas G. Gentry, Sc.D., author of "Life Histories of Birds of Eastern Pennsylvania;" "The House Sparrow;" "Nests and Eggs of Birds of the United States;" "Family Names," etc. Philadelphia: Burk & McFetridge Company. 1897. Pp. 489. Price $2 50.

Dr. Gentry in this very attractive work describes what are somewhat inadequately termed the curiosities of natural history. It is devoted largely to the most striking features of animal life, to nest building fishes, to details of animal habits and to many similar topics, so as to make, in a certain sense, condensed reading in the field of natural history. It is quite numerously illustrated by rather characteristic drawings. Dr. Gentry chronicles a battle between ants, describing such an event with perhaps not quite the minuteness given to it by Thoreau and the classic author cited by him, the author alluded to by the Concord naturalist. The book is so general in its topic that its lack of an index is hardly to be noted as a defect.

AMERICAN PLUMBING PRACTICE. From the Engineering Record. A selected reprint of articles describing notable plumbing installations in the United States, and questions and answers on problems arising in plumbing and house drainage. With five hundred and thirty-six illustrations. New York: The Engineering Record. 1896. Pp. 260. Price $3.

The Engineering Record, formerly the Sanitary Engineer, has had a long and honorable career in the field of the literature of plumbing. The articles of which the present volume is composed are extracted from its files. With each article is given its date of publication. The principle with the paper always has been to illustrate articles very liberally, and the result of this rule of action gives us a volume in which the illustrations occupy probably as much space as the text. It is most interesting to turn over its pages and to see how thoroughly the field is covered. In many cases the articles are descriptive of the plumbing of specified houses, such as the Holland, the Waldorf and the New Netherlands, and other examples of almost equal interest are given. An exceedingly interesting portion of the book consists in answers to inquiries which have been published from time to time in the columns of the paper. To this portion alone nearly fifty pages are devoted. We warmly commend the volume.

THE MECHANICAL ARTS SIMPLIFIED. A work of reference. Ice making and electricity. Compiled and arranged by D. B. Dixon. Appropriately illustrated. Chicago: Laird & Lee. 1897. Pp. 497. Price $2.50.

This book, not adequately described by its title, is really a book of tables for all classes of workers in mechanical arts. It is very acceptably printed and contains a very large quantity of matter which will be thoroughly useful to any one working in the field of practical mechanics.

GOSPEL OF THE STARS; OR, WONDERS OF ASTROLOGY. By Gabriel. With introduction by George H. Hepworth. New York: The Eskdale Press, 2 Madison Avenue. 1897. Pp. 194. 12mo. Price $1.

The object of the author in writing the present book has been to aid in popularizing the once famous but long neglected science of astrology.

PHILOSOPHY OF PHENOMENA. By George M. Ramsey. In two parts. I. Metaphysical Phenomena. II. Physical Phenomena. Boston: Banner of Light Publishing Company. 1897. Pp. 208.

MEDICAL CLIMATOLOGY. By S. Edwin Solly, M.D. Philadelphia and New York: Lea Brothers & Company. Pp. 470. Price $4.

A doctor who has for thirty years made a special study as to the effects of climate in the prevention and treatment of disease presents us in this volume the results of his investigations. Climatic observations from all parts of the world are here collated and compared, the work of others being systematized with that of the author, and it is the conclusion of the author that "it is possible to prescribe a climate with as much precision as a drug, and with far greater effect in appropriate cases," and that climatology has a proper place as "one of the most definite and useful of the medical sciences." It would be well if every doctor and every patient, before putting faith in what are often empirical and biased accounts of various health resorts, would consult these pages for full information and exact details, given without prejudice or favor, and thus be able to judge wisely in directing or accepting a change of climate on account of ill health or constitutional infirmity.

ELEMENTARY GEOLOGY. By Ralph S. Tarr. New York: The Macmillan Company. Pp. 500. Price $1.40.

The author, a professor of dynamic geology and physical geography at Cornell University, in this book furnishes a companion and adjunct to his "Elementary Physical Geography," previously published. The book is fully illustrated, the materials for the pictures being largely afforded by specimens in the geological laboratory of Cornell University, although many very interesting pictures are from other original sources. The book is most entertainingly written, has nothing of a dry, technical character, and is especially adapted to be most interesting to the young.

THE GHOST DANCE RELIGION AND THE SIOUX OUTBREAK OF 1890. By James E. Mooney. Fourteenth Annual Report of the Bureau of Ethnology. J. W. Powell, Director. 1896. Washington: Government Printing Office.

This beautiful quarto of 500 pages, handsomely printed and beautifully illustrated, forms Part II of the 14th Annual Report of the Bureau, and is as splendid an example of the care and thoroughness with which the government has prosecuted investigations relative to the history and actual condition of the native Indian tribes as was the former volume on aboriginal architecture, textile weaving, etc. The investigations of the ghost dance religion were commenced by the author in 1890, when this particular phase of Indian life began to attract general attention, and were continued through three years. The dance, however, continually develops new features, and differs in important details among the various tribes, being in a general way a sort of Indian religious revival, founded on primitive doctrines of the Messiah and belief in the teachings of the various Indian prophets. Besides indicating as far as possible the origin and phases of these beliefs, and describing the costumes and actions of the dancers, the book presents a large number of the songs of the different tribes, in their original tongue and with English translations. The

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songs include those of the Arapaho, the Cheyenne, the Comanche, the Paiute, the Sioux, the Kiowa, the Wichita, the Delaware, and other Indian tribes. These volumes, published under the supervision of the Smithsonian Institution, form a valuable addition to any library in which the department of ethnology is specially represented.

THE CHEMISTRY OF POTTERY. By Karl Langenbeck. Easton, Pa.: The Chemical Publishing Company. Pp. 197. Price $2.

The superintendent of the Mosaic Tile Company, Zanesville, Ohio, former superintendent of Rookwood Pottery, and chemist of the American Eucaustic Tiling Company, in this little book presents mainly the results of his personal experience, as a more direct expression of the practical needs of the working potter. Only bodies and glazes are considered, colors and decorating generally not being within the limits the author has prescribed for himself, but the book is full of practical details, and is evidently very thorough, as to the making of all plain pottery, tiles and terra cotta.

UNITED STATES COMMISSION OF FISH AND FISHERIES. John J. Brice, Commissioner. Part XXII. Report for year ending June 30, 1896. Washington: Government Printing Office. 1897.

One year's work of the National Fish Commission, as described in this report, is easily seen to be of great and growing importance. There are now twenty-two stations under the control of the commission, scattered over the country from Maine to Oregon, and by means of the cars and messengers of the commission there were distributed during the year, in suitable public and private waters, 498,488,268 eggs, fry, yearlings and adults of various fishes. Among the species were—whitefish, 189,740,000; lobsters, 97,079,000; shad, 93,481,500; salmon, 10,845,852; lake trout, 8,996,618; flatfish, 8,472,000. Plants were made in all the States and Territories, and eggs were sent to representatives of foreign governments and fish cultural societies, from whom also have been received similar courtesies. A canvass of the fishing industries of the country has been a part of the work of the commission, from which it appears that in the interior waters of the country, not including the Great Lakes, some 12,000 persons find employment in the fresh water fish industry. At Boston and Gloucester, Mass., the most important centers of the fish business, these were discharged by American fishing vessels, during the calendar year 1895, 150,439,000 pounds of fish, valued at $3,551,600.

INTRODUCTION TO THE STUDY OF ECONOMICS. By Charles Jesse Bullock, Ph.D. New York, Boston, Chicago: Silver, Burdett & Company. 1897. Pp. 511. Price $1 28.

The work presents the principles of political economy in a clear, comprehensive manner and will leave the reader well informed upon all important topics. It is not only broad in scope, but is admirable in method and sound and clear cut in argument. Especial reference has been had throughout to American conditions, and amply illustrated by experience in our own country. It especially adapts the book to American students and gives them a knowledge of the important questions of the day as related to matters in which they have a close and abiding interest. While primarily intended for a text book in high schools, the author's clear acceptance of causes and effects of conditions and results will make this book very welcome to the average citizen who desires to make an intelligent study of economic problems.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(7174) C. W. asks for the dimensions of sections for Ruhmkorff coil, six inch spark, also thickness of insulation between sections. I have read every book I could get on the subject, and they give nothing but very large or small coils. A. For a 6 inch spark the secondary coil should contain 12 pounds No. 36 copper wire silk covered. This may well be wound in 8 sections of 1½ pounds each. A good way is to make a wooden spool with one side removable, on which to wind the sections. The interior diameter of the spool must fit the outside of the insulation of the primary, of course. The width of the spool will be determined by the length of your secondary. Ten to twelve inches is a suitable length with 14 inch core of primary. The insulation between the sections, if of ebonite, should be from 1/16 to 1/8 inch. Now, if you follow above dimensions, there will be 7 insulating disks between sections, occupying 7/8 inch. The two end pieces will perhaps be 1/2 inch each, leaving about 10 inches for the wire, or 1¼ inches for each section. When you have wound 1½ pounds on a bobbin you will obtain the outside diameter of your coil, which of course depends very much on the evenness of the winding, etc.

(7175) A. H. H. asks: Will you please let me know, through your Notes and Queries of the SCIENTIFIC AMERICAN, the proper way to leave storage batteries for a number of months? I have heard that if the cells are well charged and the solution then drawn off, they may be kept indefinitely. Is this true? A. When storage battery cells are not required for use, charge them fully, and discharge them at the usual rate for a short time, say a couple of hours. The plates should then be removed from the jars, rinsed in clear water, dried, and put away in a dry place. Before using again put the battery together and charge fully.

(7176) W. L. McK. says: Will you please let me know how to stereotype type forms, through your Notes and Queries? A. For information regarding stereotyping you are referred to Mr. Bolas' exhaustive series of papers on the History and Art of Stereotyping, in SUPPLEMENT, Nos. 773, 774, 790. Price ten cents each.

(7177) R. L. says: Will you please let me know, through your instructive weekly paper, the process of preparing natural plants, making them imperishable or everlasting? A. To preserve the natural color of plants, dissolve 1 part of salicylic acid in 600 parts alcohol. Heat the solution to boiling point in an evaporating dish and draw the plants slowly through it. Shake them to get rid of the superfluous moisture, and then draw between sheets of blotting paper under pressure in the ordinary manner. In all cases the blotting paper must be frequently renewed. It is said powdered boracic acid yields nearly as good results.

SCIENTIFIC AMERICAN BUILDING EDITION

JULY, 1897.—(No. 141.)

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No. 1. Perspective elevation, in colors, and floor plans of a Colonial residence at Overbrook, Pa. A unique design. Mr. Thomas P. Lonsdale, architect, Philadelphia, Pa.

No. 2. Colonial house at Richmond Hill, N. Y., recently erected at a cost of $4,200. Perspective view and floor plans. An attractive and pleasing design. Architects, Messrs. Haugaard Brothers, Richmond Hill, N. Y.

No. 3. A residence, in the Colonial style, recently erected at Larchmont, N. Y., for Mr. William Murray, at a cost of $7,700 complete. Two perspective elevations and floor plans. A pleasing design, with excellent interior arrangement. Mr. Frank A. Moore, architect, New York City.

No. 4. A cottage at Prohibition Park, Staten Island, recently erected for Mr. August Mayer at a cost of $2,250 complete. A very attractive design for a modern cottage of small dimensions. Perspective elevation and floor plans. Mr. John Winans, architect, Prohibition Park, Staten Island.

No. 5. "Wyandauk," the country residence of Lieut. Morton at Southampton, Long Island. A most excellent design in the Colonial style. Two perspective elevations and floor plans. Mr. James B. Lord, architect, New York City.

No. 6. A modern dwelling at Binghamton, N. Y., recently erected for Mr. William Mannis at a cost of $3,000 complete. A good example of a suburban house. Two perspective elevations and floor plans. Messrs. T. Q. Lacey & Son, Binghamton, N. Y., architects.

No. 7. A Colonial residence at Ardmore, Pa., recently erected for Dr. Louis O. Lusson. Perspective elevation and floor plans. Messrs. Boyd & Boyd, architects, Philadelphia, Pa.

No. 8. A Colonial residence at Bensonhurst, LongIsland, recently erected for Mr. Thomas A. Ritson. Two perspective elevations and floor plans. A handsome design. Architects, Messrs. Parfitt Brothers, Brooklyn, N. Y.

No. 9. A residence at West Chester, Pa., recently erected for Dr. S. Hagerty. Perspective elevation and floor plans. A design with many excellent features. Mr. Edward S. Paxson, architect, Philadelphia.

No. 10. A residence at Attleboro, Mass., erected for E. P. Clafin, Esq., at a cost of $5,500 complete. An artistic and pleasing design. Messrs. George F. Barber & Company, architects, Knoxville, Tenn.

No. 11. Perspective and interior view of the Walhalla of Ratisbon on the Danube. A costly reproduction of the Parthenon at Athens. This temple was erected at a cost of about $6,000,000, and is devoted entirely to the display of busts of distinguished Germans.

No. 12. Design for a "cozy corner."

No. 13. View of the library of Mr. Henry L. Hotchkiss, New Haven, Conn.

No. 14. Miscellaneous Contents: Fatalities to workmen.—Scaffolding.—Lime water in freezing weather.—How to make a cheap greenhouse.—Making floors warm.—Inexpensive country homes.—Improved sash lock, illustrated.—An improved door hanger, illustrated.—A novel wood working machine, illustrated.—Gray bricks.—Dixon's silica graphite paint.—A convenient gage for carpenters and builders, illustrated.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

The Growing Popularity of New England's Lakes.

Some day there will arise a poet or writer who will do for New England's lakes what other poets have done for the famous lakes of Europe, and embalm their beauties and attractions in enduring verse or prose. The subject, as a whole, is one that has not yet been done full justice to in this respect; and, indeed, it is to be feared that the people of New England themselves are not fully awake to the value of this particular heritage that Providence has bestowed upon them.

There is an indefinable charm attaching to these aqueous gems of our mountains and wildernesses that is slowly but surely beginning to impress itself upon the great vacation seeking public, and the lakeside resorts of New England are beginning to loom up as formidable rivals to the more extensively advertised, and hence more noted, seashore resorts.

Such glorious lakes, for instance, as Winnipesaukee, Asquam, Sunapee, Newfound, Spofford, Dublin or Willoughby, in New Hampshire, have already reached a secure and superior footing as summer resorts, and there are dozens of other lakes and lakelets—some of them near at hand, others more or less remote from the great centers of population—that are gradually coming into prominence in this way. Then, too, there are the myriad lakes of Maine and the glorious waterways of the Green Mountain State, all extending a bright and smiling welcome to those who prefer the poetry and semisolitude of a lakeside outing to the more vigorous atmosphere and restless spirit of the seashore. For those who enjoy the pleasure of "camping out," almost any of these places offers unrivaled facilities.

Columns might be written in praise and description of this department of outdoor summer life in New England, but the best medium of information to which the reader can be referred is the attractive illustrated pamphlet, "Lakes and Streams," which will be sent on receipt of two cent stamp, on application to D. J. Flanders, General Passenger Agent, Boston & Maine Railroad, Boston.

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JULY 6, 1897,

AND EACH BEARING THAT DATE.

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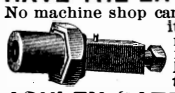

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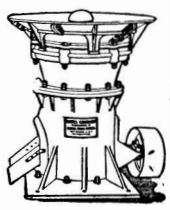

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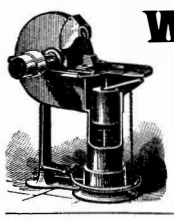

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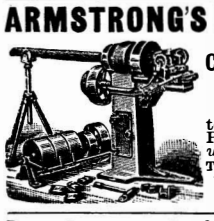

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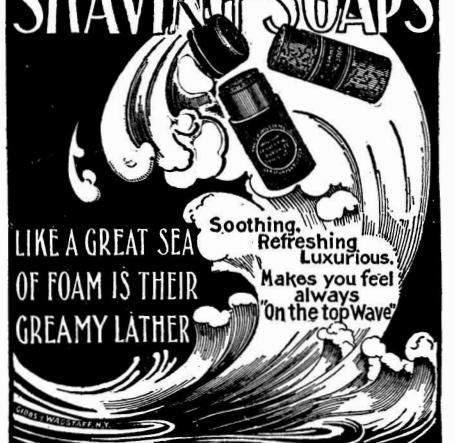

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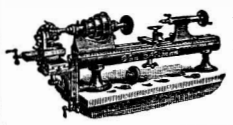

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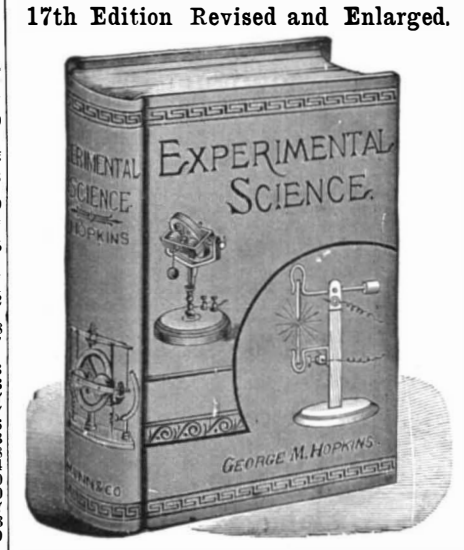

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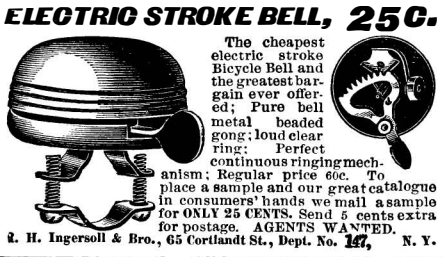
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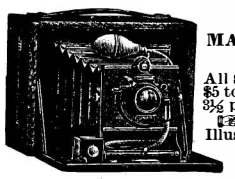
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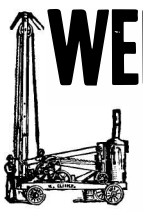

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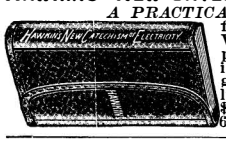
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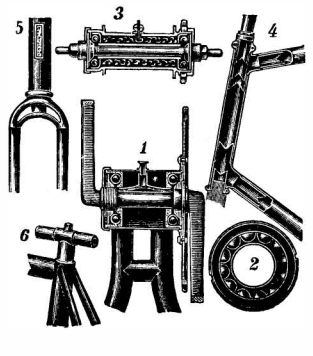

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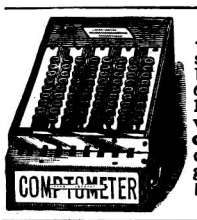

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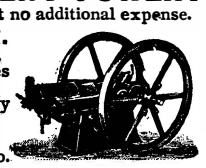

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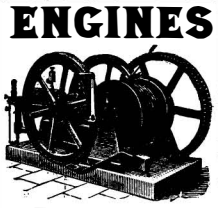

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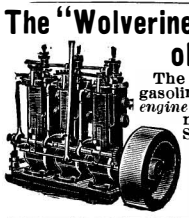

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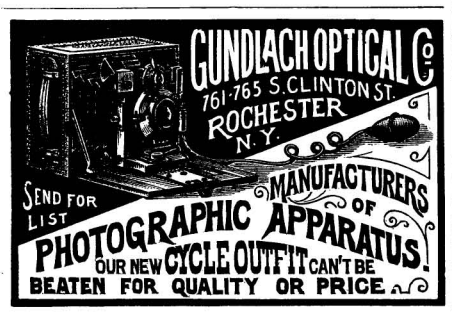

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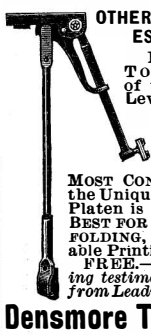

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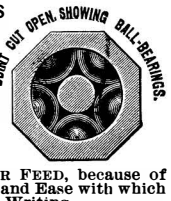

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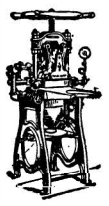

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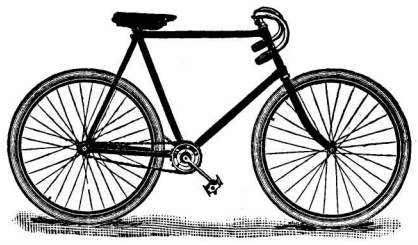

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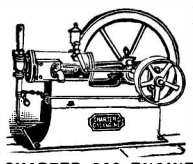

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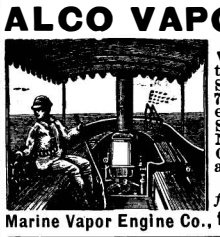

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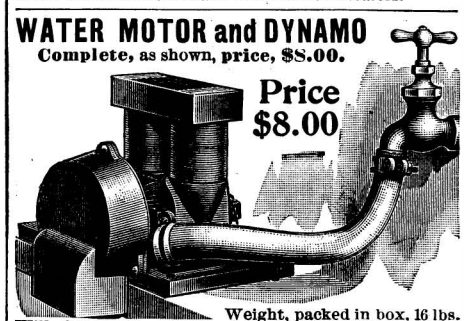

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